



**TECHNIQUE OF TREATMENT
FOR THE
CEREBRAL PALSY CHILD**



Treatment well worth while.

TECHNIQUE OF TREATMENT FOR THE CEREBRAL PALSY CHILD

by

PAULA F. EGEL

Cerebral Palsy Director, Children's Hospital
Buffalo, New York

INTRODUCTION

by

WINTHROP M. PHELPS, M.D.

Medical Director, Children's Rehabilitation Institute
Baltimore, Maryland

APPENDIX

by

MOIR P. TANNER, F.A.C.H.A.

Superintendent, Children's Hospital
Buffalo, New York

Drawings by
Dorothea Mattlin

St. Louis
THE C. V. MOSBY COMPANY
1948

COPYRIGHT, 1948, BY THE C. V. MOSBY COMPANY
(All rights reserved)

Printed in the
United States of America

Press of
The C. V. Mosby Company
St. Louis

**TO MY
MOTHER AND DAD**

PREFACE

This is the treatment of cerebral palsy as it is prescribed by Dr. Winthrop M. Phelps, who is an authority on the subject. These ideas and treatment techniques have been developed through his untiring efforts and skill, and have been put to use by his many trained workers. Dr. Phelps devotes most of his time to the cerebral palsy problem, educating people to the need for such work. A good part of it is spent in traveling to all parts of the United States, examining and prescribing treatment for the cerebral palsy patient.

The field is a most challenging one, so much so that I have been prompted to put down in black and white a record of the treatment and the philosophy behind it. This is made possible through my rich and stimulating association with Dr. Phelps. My hope is that this work will perform two functions; one, that it will introduce this form of treatment and, in so doing, interest some one in taking the necessary course of study; second, that it may be used as a guide to those already trained in the field.

I am confident that some day the knowledge of cerebral palsy conditions and the treatment methods will become so extended that troubled parents will be advised wisely, saving them considerable expense, unnecessary anxiety, and, in some instances, actual heartbreak.

Buffalo, N. Y.

P.E.

ACKNOWLEDGMENT

The author wishes to thank Dr. Winthrop Morgan Phelps for his invaluable advice and interest; Moir P. Tanaer, Superintendent of Children's Hospital, Buffalo, for his constant encouragement in times of stress; Dorothea Mintline, a parent who has given her services that other children may have the same help her child has had; and Jean VanPetten, whose editorial work was done in the hope that these children may never again be forgotten.

P.E.

INTRODUCTION

This book presents the problems of treatment of cerebral palsy from the point of view of the one who actually carries out the treatment procedures recommended by the physician. Miss Egel has been working almost exclusively with cerebral palsied children for many years and her experience has covered many different types. Her work in the Newark State School, Newark, New York, provided her with a clear picture of the reactions of the mentally defective cerebral palsy as compared to her experience with the mentally normal group in the special schools for this latter type such as the Children's Rehabilitation Institute in Baltimore and her present school connected with the Children's Hospital in Buffalo. She has also treated individual children in their homes and there has observed the specific problems of family adjustment and methods best adapted to home treatment in general. She has had a wealth of varied types of experience with these children which has contributed to her conclusions as to specific methods and procedures. Since no two of these children are alike, it is very difficult to decide on actual procedures advisable in the individual case, but this book will definitely serve as a manual which can be followed to obtain the best results possible.

WINTHROP M. PHELPS, M.D.

CONTENTS

	Page
INTRODUCTION	
INTRODUCTION	11
By WINTHROP M. PHELPS, M.D.	
CHAPTER I	
CEREBRAL PALSY HISTORY	17
CHAPTER II	
CEREBRAL PALSY CLASSIFICATIONS	20
CHAPTER III	
DIFFERENTIATION OF CEREBRAL PALSY MUSCLES	23
CHAPTER IV	
PERSONALITIES	27
CHAPTER V	
AIMS OF TREATMENT	31
CHAPTER VI	
DIAGNOSTIC TESTS	36
CHAPTER VII	
MODALITIES	46
CHAPTER VIII	
MASSAGE	48
CHAPTER IX	
PASSIVE MOTION	51
CHAPTER X	
ACTIVE ASSISTED MOTION	62
CHAPTER XI	
ACTIVE MOTION	68
CHAPTER XII	
RESISTED MOTION	73

	Page
CHAPTER XIII	
CONDITIONED MOTION	76
CHAPTER XIV	
AUTOMATIC OR CONFUSED MOTION	118
CHAPTER XV	
COMBINED MOTION	124
CHAPTER XVI	
REST	128
CHAPTER XVII	
RELAXATION	132
CHAPTER XVIII	
MOTION FROM THE RELAXED POSITION	152
CHAPTER XIX	
BALANCE	155
CHAPTER XX	
RECIPROCATION	168
CHAPTER XXI	
REACH AND GRASP	176
CHAPTER XXII	
SKILLS	178
CHAPTER XXIII	
CEREBRAL PALSY TRAINERS	182
APPARATUS AND EQUIPMENT	
APPARATUS AND EQUIPMENT	184
APPENDIX	
ORGANIZATION OF A CEREBRAL PALSY DEPARTMENT IN A CHILDREN'S HOSPITAL	190
By MOIR P. TANNER, BUFFALO.	

**TECHNIQUE OF TREATMENT
FOR THE
CEREBRAL PALSY CHILD**

TECHNIQUE OF TREATMENT FOR THE CEREBRAL PALSY CHILD

CHAPTER I

CEREBRAL PALSY HISTORY

Cerebral palsy in children was first recognized by Dr. William John Little in the year 1862. It was then called Little's disease. A child who walked with a cross-legged gait, who drooled, perhaps grimaced, and who was believed to be feeble-minded was Little's description of the spastic. Dr. Little made no distinction for different types of brain damage; the term spastic was used for all children suffering from Little's disease. Now we know from study and observation that spasticity is just one of several types of cerebral palsy.

The so-called spastic, the child with Little's disease, was not at first considered treatable, and so that child did not have a chance in the world. Instead, he was placed in an institution and forgotten. This was due largely to Little's description of the condition. Time and effort were not expended upon the child believed to be feeble-minded. Fortunately, there have been a few individuals specifically interested in this group, and, as a result of their efforts, a great deal can now be accomplished.

Although all children physically handicapped by brain damage are commonly called spastics, the term will here be used to indicate only the true spastic condition. The term cerebral palsy covers all types.

It has long been held that any injury to the brain may cause spasticity. We know now that damage to specific areas of the brain cause other conditions as well as spasticity. The area, which when damaged produces

spasticity, lies very near the mental area and, even though feeble-mindedness may occur, it is not characteristic of the condition. Retardation can be present due to the physical handicap.

These children do not have the assured advantages of normal children. Too little has been known, until recently, to have set up any kind of standard program which would compensate for the fact that they have been handicapped since birth.

A birth-injured child has to be taught activities which normal children learn naturally as the age level for the particular activity is reached. For instance, many of these children have to be taught to suck and swallow, lack of which normally natural knowledge causes a poor start in life. Without this knowledge the eating habits are slow and difficult to form, and so the mother is confronted with tremendous problems from the start. The problems naturally become greater and more frightening as the child grows. It is necessary to teach the child, often laboriously, each simple physical activity that a normal child learns spontaneously.

Prior to starting the treatment program it is a good plan to give each cerebral palsy child a psychological examination. The trainer will benefit greatly by this test since a better understanding of the child's capacity for learning will be known. In some instances, time is wasted during treatment because the commands given are beyond the child's ability to understand. This test given by the psychologist will also determine the length of time the child needs to comprehend and respond to a command. The timing varies with each child and should be known if possible at the start of the training.

It is extremely difficult to give a mental test to a child in this group since the handicap it suffers may involve all physical motions required for such a test. A child may not be able to respond, even if the requirement is only a smile. Because of this, all tests must be modified to fit the handicap of the child. Fortunately, there are a great many cases where an accurate intelligence quotient

can be obtained. Miss Elizabeth Lord, of Boston, and the Research Department of the Vineland Training School in New Jersey have done a great deal to advance the methods now used in testing the intelligence of these children. We feel, however, that every child, regardless of mental test findings, should be given the chance to be trained, then if treatment proves to be of no avail it may be discontinued.

Since there are not enough trainers at the present time for all cerebral palsies, it is necessary to limit the work to those children whose improvement will have the greatest practical value. Any help that is given to a cerebral palsy rehabilitates the entire family, no matter how slight the improvement. At the Children's Hospital in Buffalo, New York, each child accepted for treatment in the Cerebral Palsy Department is allowed a probationary period of three months, at the end of which time he is expected to show some actual improvement. Three months is a satisfactory period in which to determine whether treatment should be continued.

CHAPTER II

CEREBRAL PALSY CLASSIFICATIONS

Since the treatment for cerebral palsy was first begun the general method has changed considerably. Keep in mind that the search for knowledge has no end, those of us who have been engaged in this type of work know that changes will still be made which will make the end result even more gratifying than it appears to be at the present time. However, the treatment of today is sufficiently standardized so that it can now be described, not only for the use of those already in the field, but for the purpose of interesting others who do not appreciate its value.

Cerebral palsy covers a variety of conditions resulting from brain damage. *Cerebral* refers to any part of the brain within the skeletal border. *Palsy*, a term preferred to its synonym paralysis, refers to the condition of the muscles. Damage to certain areas of the brain, no matter how caused, produces a specific type of involvement in one or more muscles. The site of involvement depends on the site of the brain damage, since each muscle in the body is controlled by a definite area of the brain.

Finding the disorders of the muscles helps to determine the diagnosis of the case. It is the work of the doctor to make the diagnosis, and it is the work of the technician to treat the involved muscles. In this way the best results from treatment can be obtained. The person treating the child must have a thorough understanding of all cerebral palsy conditions, must be able to detect any abnormalities of the muscles and must know how to treat them. In some instances the wrong classification is given to the individual child, which makes little differ-

ence If muscles are re-examined by the trainer; the physician is consulted, and then treatment is given according to the results of these examinations.

Cerebral palsy cases have been divided into five main general types, namely: spastic, athetoid, tremor, ataxia, and rigidity. The spastic is a pyramidal tract condition and cortical in origin. The damage which produces spasticity lies directly behind the frontal or thinking area, and it is the only type which may or may not have mental impairment due to the identical injury. Damage to this area affects the muscles directly and the stretch reflex is a special characteristic of this condition.

Damage to the basal ganglia brings about an athetoid condition which involves the joints of the body. This portion of the brain acts as a filter and sorts out the desired motions. When it is damaged the sorting function is eliminated and all impulses pass through, causing involuntary motions of any parts of the body. An athetoid does not have the ability to control the direction of the motions and is unable, therefore, to complete attempted voluntary movements at will. Feeble-mindedness, if found in the athetoid, has no relation to the athetoid condition since the basal ganglia, unlike the motor cortex, is far from the frontal lobe.

It was believed at one time that the combination of spasticity and athetosis was frequent, but on careful study it has been found that, although the combination does occur, it is comparatively rare. If the two specific parts of the brain producing spasticity and athetosis suffered great damage, the extent of injury would be so great that the child would probably not survive. However, there is a certain kind of hemorrhage, petechial hemorrhage, pin point in size and extending over many areas of the brain, which may produce the combination of athetosis and spasticity.

The basal ganglia may produce an involuntary motion that is reciprocal in action and is called a tremor. In order to understand the differences between the involuntary motions, athetosis and tremor, let us suppose the

wrist flexors are athetoid. The athetoid pull will cause the hand to drop and return to its neutral position. However, if the involuntary motion is of a tremor type, the hand will flex and then extend beyond the neutral plane. In this way, the action of the wrist is reciprocal in nature, causing as much motion in one direction as in the other. The tremor may vary as to the speed and range in different joints of the body and may be of two types, intention and nonintention. Intention tremor occurs during the voluntary attempt to move at will, while the nonintention tremor is more or less constant.

Ataxia is caused by damage to the cerebellum, the brain center controlling balance. The functional disorder can be treated by retraining the voluntary motor centers to take over the function of the damaged balance mechanism. The kinesthetic sense, the ability to know the position of joints in relation to the other parts of the body, is lacking in the ataxic child. The child also has marked difficulty in controlling the direction or force of motion once the voluntary action has been started.

Upon examination, the cerebral palsy child who has stiffness in the muscles of the arms and legs, but has no involuntary motions or stretch reflexes present, may be classified as a rigidity. This type of child differs from the true spastic, since his muscles respond slowly and with difficulty when a stimulus is applied. Rigidity is usually caused by a diffuse lesion rather than one that is localized, and very often occurs after a convulsive seizure. A rigid muscle lacks elasticity and is stiff in either a flexed or extended position or may have intermittent rigidity, in which case the rigidity is not constant. Rigidity will not be treated as a separate classification since the child with rigidity is treated in the same manner as the spastic child is treated with the exception that a faster rate of speed is used in the exercise. Since there are no stretch reflexes present, the rigidity subsides when the arms and legs are exercised to a fast rhythm.

CHAPTER III

DIFFERENTIATION OF CEREBRAL PALSY MUSCLES

For the cerebral palsy therapist it is extremely important to consider all children in the group from the treatment rather than from the diagnostic angle. The neurological diagnosis determines whether or not treatment is advisable for the individual child. If a child is proved to be feeble-minded, or epileptic, or has a progressive condition, this form of treatment has little or no value. For these children other types of therapy may be indicated.

The trainer should recognize the disordered muscles as well as the normal ones. This is far more important than knowing the neurological diagnosis, since treatment deals specifically with the individual muscles.

Normal muscles ordinarily remain quiet when not in use, and are capable of contracting to the degree of tenseness that will counteract gravity. This is best explained by using the head as an example. When a person is sitting upright, the neck muscles are held contracted to a degree that the head may remain still and in an upright position. When a normal muscle contracts its antagonist must relax, thus allowing the muscle tone to become lowered enough to allow the desired motion to be carried out. This is known as "Sherrington's Law of Reciprocal Innervation."

The spastic muscle is hyperirritable and reacts to any stimulus. It reacts by contracting. The most common reaction is to a stretch stimulus which can be applied passively by the trainer or can just occur as a natural stimulus. In either case the reaction on the part of the antagonist muscle is the same and is known as the stretch reflex. To understand this better let us suppose

that a biceps muscle is spastic. In extending the elbow from flexion, by means of the triceps, the biceps muscle is put on a stretch which is enough of a stimulus to cause the biceps to contract. This contraction may halt the motion entirely; it may stop the motion momentarily, allowing it then to continue, or allowing only a slow, uninterrupted motion. The degree of spasticity is indicated by these variations of the stretch reflex diminishing in the order named. In the case of the interrupted motion, an immediate contraction indicates a greater degree of spasticity than a more delayed one. In order to test for spasticity in the biceps muscle the trainer should place the muscle in its contracted position and by moving the part quickly in the opposite direction, feel for any blocking or slowing up of the motion that would indicate spasticity. This stretch reflex test should be given to every muscle in the body.

Another type of muscle disorder falling in the spastic group is known as an O.C. muscle. O.C. means zero cerebral. An O.C. muscle is flaccid and is similar to the zero muscle found with the poliomyelitis case. The terminology explains that the location of the injury, however, is in the brain rather than the spinal cord. It is tested in the same manner as muscles affected by poliomyelitis. This is done by asking the child to move voluntarily all the muscles in the body, one at a time. Any muscles that cannot contract the trainer should observe closely and test thoroughly by placing the part that is being tested in its contracted position to see whether the child can hold that position. If this muscle cannot contract it should be recorded as an O.C. muscle. An O.C. muscle has no voluntary power to contract at will. Any muscle in a spastic child that shows no spasticity must be retested for O.C. muscles. It is important to find them as the treatment is entirely different and will be described under the chapter Automatic or Confused Motion.

Athetosis may be described as a condition existing in muscles which brings about contractions without

voluntary direction, and without voluntary control. The athetosis involves the involuntary motions only; therefore, the voluntary motions are unaffected. A set of involuntary motions start up on a voluntary act so that the motion becomes distorted and, as a result, is steered in the wrong direction. Athetosis is more or less constant without definite pattern and is variable as far as degree and selection of muscles is concerned.

The athetoid who makes no attempt to stop these involuntary motions, and is free from blocking or resisting muscles, is known as a nontension athetoid. The athetoid who voluntarily tenses to stop these involuntary motions is a tension athetoid. The tensing of muscles becomes habitual in time and the strength becomes excessive, which produces extreme stiffness to the parts of the body involved.

This picture is at times similar to the spastic and is often mistaken for it. However, there are a few tests that will help the trainer decide to which group the child belongs, since the two types react in opposite ways. For one thing, the tension athetoid does not increase the tension in his muscles when something upsetting occurs, such as a loud noise or a sudden movement. The tension in a spastic muscle does increase under the same stimulus. Also, if the extremity which displays tension is shaken rapidly by the trainer for a time complete relaxation will occur, thus proving the child to be a tension athetoid and not a spastic.

Overflow is another condition which exists with the spastic and athetoid and has not yet been mentioned. Overflow may be one of two types, pathological or normal.

Pathological overflow is associated with the disease and can be found with either the spastic or athetoid. A stretch reflex occurring in a muscle may produce additional stretch reflexes in other parts of the body. These added reflexes would then be pathological overflow. In athetosis, the motions around a joint may be such that

additional athetoid motions may start up in other joints. They are, for the most part, seen in the same extremity, but can occur any place in the body. These, also, are pathological overflow.

Normal overflow is so named since it resembles the overflow found in normal people. For instance, for a simple act such as opening a door that is difficult to open, excess motions will appear somewhere in the body. The person performing the act screws up his face, grunts, tightens distant muscles, none of which actions actually help in the function of opening the door.

The same type of overflow may be found anywhere in the body when a spastic or athetoid is asked to make a purposeful motion.

The distinction for the trainer between the two types is clearly revealed in treatment. However, it may be said that pathological overflow is virtually continuous with the athetoid movement and normal overflow appears only at the attempt of a voluntary act.

CHAPTER IV

PERSONALITIES

If the ultimate aim for training the patient with cerebral palsy is to make him a self-sufficient person then, for the best results, it is important to know the personality or make-up of the individual receiving treatment. The trainer will be better qualified to handle situations as they arise if she has an understanding of the individual. For the most part the cerebral palsy patient is handicapped by his own character and, unless his personality is molded through training, the desired aim will not be reached.

The personalities of the five main types, spastic, athetoid, tremor, ataxia, and rigidity, differ greatly and must be recognized by the trainer before starting the physical training. It is extremely important for the patient receiving training to be approached in the proper way.

Few cerebral palsy patients adjust readily when they are starting treatment. It is, therefore, advantageous if this adjustment period can be shortened as much as possible. Any unpleasantness that may occur will have a lingering effect on the individual and will hinder the beginning of the training. A child who spends his first few treatment periods crying, and who begins them with a negative attitude, will require wasted time from the trainer spent in attempting to win him over. This can be avoided if the trainer knows ahead of time what approach to use for that individual and this approach can be successful only if the general character is known.

The personalities found with the spastic and athetoid are direct opposites and run true to form. The differences are so great and so noticeable that a diagnosis of the physical condition can almost be made by an observation of character. The spastic is a shut-in type and is

considered an Introvert while the athetoid has all the characteristics of an extrovert. The spastic patient presents a picture of tightness due to the fact that fear is highly developed. He holds himself tense as a means of protection against anything that may be of a disturbing nature. The muscles in a spastic patient react involuntarily, by contracting without warning to any outside stimulus. Therefore, in order to minimize the degree of contraction, the spastic holds himself in readiness by keeping all of his muscles tensed.

Any outside stimulus may produce fear, such as the fear of falling, fear of loud noises, sudden jars, et cetera. The athetoid on the other hand is quite fearless. His reaction to these stimuli is that of a normal person. Their effect upon him is disturbing but is soon forgotten.

The spastic does not like to meet new people and is afraid of strange situations. He prefers to stay alone in the environment he knows best, whereas the athetoid likes to mingle with people, preferably normal ones, does not care how he looks and pays no attention to what is thought of him. Love and affection are highly developed in the athetoid, largely due to his lack of fear of people. The same is not true of the spastic since he is constantly afraid that muscular contractions will occur. Therefore, unconditioned spastic children, prior to treatment, prefer verbal expressions of pity to demonstrations of love.

The spastic and athetoid both experience periods of anger. The spastic is slow to show anger, and maintains the state of emotion for a short time; the athetoid, on the other hand, is quick to show it and holds it for a comparatively long time.

The ataxic child has characteristics resembling those of an athetoid. Fear is not too highly developed. The awareness of not being able to direct a motion, once started, produces anger or rage in the ataxic. This is strongly evidenced during treatment when he is asked to repeat an action which is at all difficult. The ataxic hates repetition and gives up quickly. Affection is tightly

developed, even in comparison to the athetoid. In some instances, the ataxic will interrupt his treatment in order to find out whether he is liked by the person working with him. He is quite demonstrative and, as a result, does not progress as rapidly when he feels that love is lacking. The ataxic makes friends easily, both with others who are handicapped and with normal persons. For the most part, the ataxic child is a lovable child.

The characteristics of the nonintention tremor resemble those of the athetoid, whereas the personality of the intention tremor is comparable to that of the spastic, even though fear is not as highly developed. However, the inability to move a part, because the tremor distorts the motion, produces fear.

When starting the treatment for any of the cerebral palsies, it is important to remember the make-up of the individual and to avoid situations that may slow up the training. The spastic probably requires more consideration than any other type due to the amount of fear he possesses. In some instances, it is a good plan to have the spastic come into the treatment room and become acquainted with the new surroundings before starting actual treatment. It should also be remembered that, when introducing any new phase of treatment, the spastic should be forewarned. After treatments have been given for a time he will lose some of his fear through conditioning. Personality changes will then occur. He will try to do things more willingly and will even attempt activities on his own and, therefore, will become less introverted.

CASE STUDY

C.W.—A marked change of personality has taken place in a boy who is still receiving treatment at Children's Hospital in Buffalo. Treatments were started when he was about three years of age. Spastic muscles to a marked degree were found in all four extremities. He could not sit, stand, or lie on the treatment table without support. Though nothing was wrong with his

speech, he spoke only in a whisper. He tightened up completely whenever anyone came near; he was fearful of the radio when it was turned on. The thought of fear was always in his mind, keeping him, inevitably, in the background. Today, three years later, this boy is completely changed. His entire outlook and personality, together with his physical condition, have altered greatly. At present there is little that he cannot do for himself in spite of the fact that he still uses crutches. Even with those he travels at a fast pace. He no longer whispers but shouts and is now a participant instead of an onlooker.

The trainer must mold the personality while treating the physical handicap, and this must be done if the child is to become self-sufficient.

CHAPTER V

AIMS OF TREATMENT

Training is essential for a large percentage of these cases and should be discontinued only if the child shows no response to treatment.

The training period is a long and slow one, which fact should be clear to the parent. If the parent understands, it helps him adjust to the idea and, consequently, tends to insure a longer training period for the child. The exact length of time required for training a cerebral palsy patient is difficult to set. It depends, to a great extent, on the degree of involvement and how much has to be accomplished through training. A pianist, for instance, never reaches a point where practicing is no longer necessary, regardless of the perfection of his playing. This is true of the child with cerebral palsy. Take a cerebral palsy child who learns to walk; the walking can always be perfected even after the act has been learned. It can be said, therefore, that the stopping point of treatment depends upon the wish of the individual.

The aim of treatment is not to reach normalcy, since time is an element. Rather the aim is to make the individual useful to society and to himself and thereby give him a happier adjustment to life. These aims are variable and should be decided from both the economic and physical viewpoints. This can best be done by making a careful study of the individual about to start training. In order to rehabilitate the child completely, consider first what type of life work he may do later. If this rehabilitation can be accomplished, he will become self-supporting. On the other hand, if this aim cannot be reached, treatment may achieve a second but also important end. By developing self-help he will not require the constant attention of another person, thereby releasing

the latter for more important work. Should the second aim still not be possible, due to the severity of the handicap, there is still the goal of increased happiness to be achieved. The child who has interests within his range will be able to entertain himself a good part of the time, and, in turn, will rehabilitate economically, to some extent, the family.

The severity and degree of handicap varies and should be studied very carefully in each case before starting treatment. The person with cerebral palsy has five extremities, two arms, two legs, and the speech mechanism, which may or may not have involvement. Disregarding the speech mechanism, if one extremity is involved it is called a monoplegia; if both legs a paraplegia; an arm and both legs a triplegia; both arms and legs a quadriplegia; one entire side, arm and leg, a hemiplegia. By using one of these terms for a spastic, athetoid, or ataxia, the extent of involvement is explained. However, when deciding upon the proper treatment, the severity of the condition is considered rather than the extent of involvement. The child should be seen, not as he appears at first, but as he will appear ten years later, and what his capabilities will be at that time. If this viewpoint is taken, the accomplishments gained from treatment will be much greater.

The most important extremity to an individual is speech. Without it, he can never hope to have complete independence. He can seldom be left alone in case of an emergency; his entire outlook on life is an unhappy one. If a sign language is used as a means of communication, it is usually known only within the family circle and that more or less excludes the child when strangers appear. Speech, then, should be stressed as the first important phase of training. However, since speech is a field of specialization in itself, it will not be discussed in this book.

The parts of the body next in importance to the individual are the arms. Without the ability to use them the child is helpless so far as self-help is concerned.

Since the use of the arms makes it possible to carry on all natural activities, such as tending to bathroom needs, eating and dressing, a cerebral palsy patient not having arm control is constantly under care and cannot be left unattended. This not only is a hardship for the child but it is a burden to the family. Training of the arms is therefore highly important in rehabilitating the child. A severely handicapped cerebral palsy patient who does not have the use of the arms or legs certainly requires arm control first in order that walking may some day be accomplished. With no grasping ability the child would be unable to learn balance, since the ability to hold on is essential. With corrected arm control, a cerebral palsy patient can be made independent to a large degree, if he himself is able to operate a wheel chair.

Legs are considered last in importance with a severely handicapped child. It is perfectly useless for the child to be trained to walk across the room if he is unable to do anything with his hands when he gets there. It is for this reason that walking is considered least essential to a quadriplegic child. Fear is present to a great extent in a child just learning how to walk and, as a result, this phase of treatment requires considerable time which must be anticipated.

Usually the parent thinks walking is the most important physical act and invariably asks, "Is my child ever going to walk?" without considering the whole picture that the child presents.

Special educational methods should be used for cerebral palsy, to correspond with the physical training, as soon as the child reaches school age. Physical progression will be increased if the mental side is commensurately developed. Some of the cerebral palsy children have an undeterminable hearing difficulty or eye condition which makes it necessary for the teacher to employ special methods, such as those used for the deaf and the blind, to get the best results. The cerebral palsy child should start school as soon as possible, since it will

take him longer than the normal child to complete the same work. The aim in teaching the cerebral palsy child should be to bring him up to his grade level in all subjects and this can be accomplished by utilizing these special teaching methods.

The form of treatment that is to be given as well as the treatment aim, should be explained in detail to the parent. The treatment does not perform miracles and so no positive statement can be made as to what the child will accomplish. But it is well for the parent to understand the type of treatment to be given and the degree of success that can be hoped for.

It must be remembered that the future of a cerebral palsy child is of the greatest importance and should always be kept in mind when plans for treatment are being made. Time will not be spent inadvisedly on less important phases of treatment when this is understood.

The trainer should avoid boredom for the child by setting up treatment in such a way that interest will be maintained. In order to accomplish this the program for the child should be well rounded, the trainer always keeping in mind the extremity which needs to be stressed. She can utilize different parts of the body and still keep the emphasis on the part that needs the most training. For instance, if a child makes a request to stand, and is capable of doing so by leaning against a wall, this could very well serve as a position for handwork, such as learning how to grasp. The child is happy standing and will cooperate with the trainer who, with the child standing, stresses handwork.

There are a great many combinations of activities which can be utilized thus for keeping up the interest of the child. It is up to the trainer to be ingenious. In some cases, after a child has had treatment and knows the routine, the trainer may ask the child what he would like to do that day. You may be sure that if what he wants is within reason and can be carried out, progress will be greatly motivated by allowing him to do it.

It is important to the individual to know what his general appearance is while he is performing the physical acts of speaking, using his arms and walking, if the rehabilitation is to be complete. Such things as facial grimaces, drooling, or awkward gait, have much to do with future employability. For this reason consider the following outline when training patients with any type of cerebral palsy.

Speech—Some ability to talk.

1. How fast?
2. How slow?
3. How clear, fast or slow?
4. Appearance while talking
(a) contortions, grimaces and drooling.

Arms—Eating, dressing and writing.

1. How fast does child eat, dress, write own name?
2. How neat is child while performing these acts?
3. How orderly is writing or paper after writing?
4. Appearance while eating, writing or dressing.

Legs—Locomotion (walking).

1. How far can child walk—how many steps taken, how many falls?
2. How fast is the walk—how many minutes will it take?
3. What does walk look like?
4. Does child walk without pain and without callus forming?

All these essential activities and the manner in which they are performed have to be considered in the handling of a cerebral palsy patient.

CHAPTER VI

DIAGNOSTIC TESTS

Regardless of the examination given by the doctor, each child before starting the treatment must have a muscle examination, given by the trainer and recorded on a special form sheet. This test reveals the disorder found in the individual muscles and helps acquaint the trainer with the condition of the child. The manner of testing differs with the three types, spastic, athetoid, and ataxia, and will be explained in full.

A muscle examination should give a complete picture of the child, showing where the involvement is and to what degree. It is important to record as much information on the examination sheet as possible, before starting the training, in order that the child may be well described as to general appearance caused by the handicap. The trainer should observe all existing conditions keenly and be as accurate as possible in putting down the findings. This sheet is the first form of record, is frequently referred to once treatment has started, and is a basis for future recordings.

Spastic

Spasticity lies directly in the muscle. Therefore, the form sheet for the spastic lists the names of all the prime moving muscles in the body so that, in testing, each muscle is tested individually. (See form used, page 37.)

A spastic child is given a muscle examination only once and it is best done before starting the training period. Once a muscle shows spasticity it will always be spastic. Spasticity can always be determined by the stretch reflex test, no matter how well trained the child.

Since the spastic child has a considerable amount of fear, it must be remembered that the child will be afraid

SPASTIC MUSCLE EXAMINATION

NAME DATE... .. AGE

Explanation of symbols:

Spastic (S); Normal (N); Flaccid cerebral (OC)

Confusions; In cerebral flaccid type: Example—(Tib. ant. OC—Hlopro).

Overflow: Example—(Flex. prof. dig. = wrist flexors).

L LEGS R	L ARMS R	L SHOULDERS R
Ext. hall. long.	Dorsal Interos.	Supraspinatus
Flex. hall. long.	Volar Interos.	Deltoid
Ext. dig. long.	Ext. com. dig.	Pect. maj.
Flex. dig. long.	Ext. ind. prop.	Latissimus dorsi
Ext. hall. brev.	Ext. mln. dig.	Subscap. .
Flex. hall. brev.	Flex. prof. dig.	Teres. maj.
Ext. dig. brev.	Flex. subl. dig.	Coracobrach.
Flex. dig. brev.	Lumbricales.	Infraspinatus
Dorsal Interossei		Teres. min.
Plantar Interossei	Ext. poll. brev.	Upper trap.
	Flex. poll. brev.	Levator scap.
Tib. ant.	Ext. poll. long.	Lower trap.
Tib. post.	Flex. poll. long.	Pect. min.
Peron. tert.	Abd. poll. long.	Serr. ant.
Peron. L&B	Add. poll. O&T	Rhomboids
Gastroc. sol.		
Gastrocnemius		
Quadriceps		
Med. hamst.	Abd. poll. brev.	TRUNK
Lat. hamst.	Abd. dig. quint.	Intercostals
	Oppon. poll.	Diaphragm
Hloproas	Oppon. mln. dig.	Abdominals
Sartorius	Flex. poll. brev.	Quad. lumb.
Glut. max.	Flex. dig. V. Brev.	Erector sp.
Adductors	Palmaris long.	
Glut. med.	Flex. carp. rad.	
Ext. rot.	Ext. carp. L&B	
Glut. mln.	Ext. carp. mln.	
Tens. fasc. fem.		
	Pron. quad.	
	Supinator	
	Pron. teres.	
	Brachio. rad.	
	Biceps	
	Brach. ant.	
	Triceps	
Tightness	Confusions found	
Contractures	Clonus	

of the trainer and will show it to a large degree until he is aware of the fact that he will not be hurt by either the trainer or the treatment. It may take several visits before the trainer will be able to complete the muscle examination and, in some instances, before attempting the test, it may prove worthwhile to spend the first few visits acquainting the child with the treatment room and the treatment which is to be given. If the spastic child is fearful, the test will not be accurate, due to the voluntary tensing of muscles not spastic. It is then difficult to differentiate the stretch reflex from the voluntary tensing. Never rush a spastic child into a new phase of treatment, since fear will be so manifested that time and energy will be wasted.

When the child is ready for a muscle examination, he should be placed in a supine position on the treatment table and tested for spasticity. If a muscle blocks, when put to the test, that particular muscle is known to have a stretch reflex and is, therefore, spastic. The trainer must go over the entire body and record those muscles that have stretch reflex as spastic muscles. An "S" is written opposite the corresponding muscle on the Spastic Muscle Examination form.

Only the simple joint motions are tested, thereby taking in only the muscles that are important in spasticity. The muscle being tested is placed in its contracted position and, very rapidly, is moved passively in the opposite direction, causing the tested muscle to be put on a stretch. This stretch produces a blocking when moved passively if spasticity is present, and can, therefore, be recorded as spastic.

For instance, test the leg adductor by starting with the leg in a neutral position and, while bringing the leg out to the side passively and quickly, notice whether the motion becomes blocked. For the most part, after the blocking occurs, the motion can be continued in the same direction. What the range of motion will be, depends upon the amount of spasticity found in the individual muscle.

Clonus is found in the spastic group and should be tested by means of the stretch reflex when testing for spastic muscles. A clonus may occur in any muscle in the body but is most strongly manifested in the heel cord. When testing the gastrocnemius or soleus muscles for stretch reflex, if a rapid motion like that of a tremor starts up, that is a clonus. If the clonus continues for any length of time, it is recorded as being a "sustained clonus" on the Spastic Muscle Examination form. This sustained clonus is important, if detected, in helping to diagnose the spastic. In some cases where the clonus is constant and is of marked degree, operative procedure is required in order to make walking possible. A child having sustained clonus might, in some instances, be required to wear high shoes since oxfords would not stay on the feet.

A clonus signifies that spasticity is present in the particular muscle tested and the reflex motion can be stopped by releasing the stretch put on it.

In order to test the muscles on the posterior side of the body, the child should be placed in the prone position.

When the test for spasticity is finished the trainer should start again and look for O.C. muscles. These have been described in a preceding chapter as being muscles that have no contractile ability. They do not contract at will and they show no response. Any muscle not showing spasticity should be retested to make certain that motion can be executed. For instance, if the tibialis anticus muscle in the ankle is not spastic, the child should be asked to dorsiflex the foot. If this cannot be done, the trainer should then place the foot in a dorsiflexed position to see whether the child is then capable of holding it flexed without assistance. If the part cannot be held and the foot drops down, the tibialis anticus can then be considered an O.C. muscle. Using this same manner of testing, all the nonspastic muscles in the body should be gone over. It is important, not only for treatment, but for the doctor who may be con-

sidering surgery. This technique for the O.C. muscles is unique and the results are most gratifying.

In completing the spastic muscle examination, all tightness should be recorded and the degree of contracture found should be measured. A goniometer is a good instrument for reading the degree of the joint angle and is always accurate. The contractures can be measured from time to time, using the same method, and if the contracture should show any decrease, it would then be a definite sign of progress resulting from treatment.

Another way of recording contractures accurately is by tracing the contracted part on paper with the child lying on his side, which side depending upon the location of the part to be traced. This is called a lateral

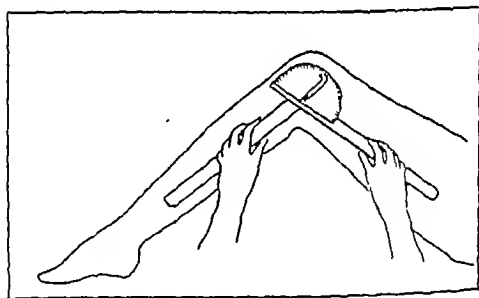


Fig. 1- Goniometer reading.

tracing and is one of the best methods for keeping a record and picture of the contracture. A great many times, if contracted parts cannot be corrected by therapeutical treatment, surgery will be tried. With a complete original record of each contracture accurate measurements can be made whenever desired. Comparison with the first measurement will very often show

that enough progress has been made with treatment to relieve the child from surgery. The same method should always be used that was used for the first measurement.

It is essential for the welfare of the child and for the best results of treatment to have a complete examining record before starting the training period.

Athetoid

In order to find athetosis, any involuntary motions that may occur anywhere in the body should be observed. The child is placed in a supine position with as few clothes on as possible. He must lie as quietly as he can, making no unnecessary motions and trying not to stop

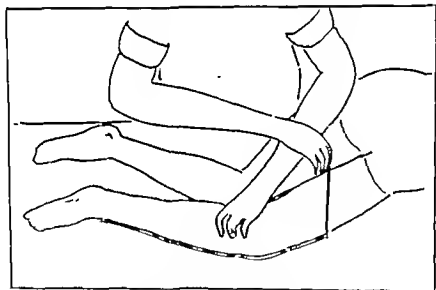


Fig. 2—Lateral tracing of left leg with patient in left side lying position.

any of the motions by tightening. The trainer must watch closely for any involuntary motions that may appear. These motions of athetosis repeat periodically even though they may appear to be constant. The timing of contraction may be slow or fast. For example, it may be discovered that the toes will flex completely and then return to a neutral position. The trainer should

watch for this flex again, regardless of the time spent and the patience required in watching. If athetosis is present, the flexors will contract and the same motion will be repeated at the same interval of time.

The trainer should go over the entire body, including the face, in this manner and write an "A," signifying athetosis, opposite the name of the motion on the form sheet. Because athetosis affects the joints and the motions of the joint, Dr. Phelps uses the Joint Motion Muscles Examination form. (See form used, page 43.) This form lists all of the motions of the body, rather than the muscles, and is used for the athetoid group only.

Due to the fact that athetosis changes when the patient is taken out of one position and placed in another, it is important to check it in all positions. When all of the motions showing athetosis have been recorded with the child in a supine position, the child should be placed in a prone, then in a left-side and finally in a right-side position and any new motions of athetosis should be recorded. All positions, other than supine, should be recorded as such when athetosis is found. When checking the athetosis the habitual position assumed by the arms, legs, head, trunk and face should be noted while the child is in the testing position.

When this phase of the test is complete normal overflow should be checked. This is done by asking the child to make a purposeful motion such as raising an arm or a leg. While the voluntary motion is taking place, the involuntary motions not already checked as being athetoid are recorded. Overflow, once spotted, will occur in the same manner every time a specific voluntary motion is made. Supposing that a child, while reaching for a pencil, rotates a leg internally; the internal rotation is the overflow and will always be noticed whenever the child reaches for a pencil. It is important to check for overflow since it can be eradicated with treatment and is treated in a different manner from that given for athetosis.

JOINT MOTION CHART — ATHETOIDS

LEFT

RIGHT

LEFT

RIGHT

Hallux

abduction
adduction
flexion distal
flexion proximal
extension proximal
extension distal

Toes

abduction
adduction
flexion distal
extension distal
flexion proximal
extension proximal

Foot

plantar flexion
dorsi-flexion
supination
pronation

Knee

flexion
extension
internal rot.
external rot.

Hip

abduction
adduction
flexion
extension
internal rot.
external rot.

Pollux

abduction
adduction
flexion distal
extension distal
flexion proximal
extension proximal
opposition

Fingers

abduction
adduction
flexion distal
extension distal
flexion proximal
extension proximal
opposition V

Wrist

flexion
extension
radial deviation
ulnar deviation

Forearm

pronation
supination

Elbow

flexion
extension

Shoulder

abduction
adduction
forward flexion
backward flexion
internal rot.
external rot.

Forehead

elevation
depression

Scapula

elevation
depression
abduction
adduction

Spine

forward flexion
backward flexion
lateral flexion
rotation flexion
chest breathing

Mouth

abduction
adduction

Head

flexion
extension
rotation

Pelvis

rotation forward
rotation back forward
lateral tilting

Jaw

opening
closing

Eyelids

The trainer will find this muscle examination very helpful in the treatment of the atheloid. It should give a complete story of the child before treatment is started. The doctor will find it helpful, also, because he, at a glance, will understand what is needed for the child and can refer back to the examination sheet after treatment has been started to note progress.

Ataxia

Cerebellar disturbances produce muscles that vary in tone and strength throughout the body. So that the child may be better understood for the sake of treatment, each muscle should be tested individually and graded, depending upon the degree of power found.

Any muscle examination sheet which lists all of the important muscles of the body can be used for testing the ataxic muscles. The position and manner of testing is the same as that used for the child with poliomyelitis. The Standard Lovett System for muscle grading may be used and is described as follows:

Zero	no contraction is felt in the muscle.
Trace	the muscle contraction is felt but without any apparent movement of the part.
Poor	the muscle moves the part through partial range of motion with gravity eliminated.
Fair	the muscle moves through the full range of motion against gravity.
Good	the muscle moves through the full range of motion against gravity and with a minimum amount of resistance by examiner.
Normal	the muscle moves through the full range of motion against gravity and can be given a maximum amount of resistance by examiner.

Through this system of muscle grading each muscle is described fully as to the amount of power found; this is the important factor with the ataxic child.

It is also a good plan to note the physical capabilities of the individual child, making the picture as complete as possible.

CHAPTER VII

MODALITIES

According to Dr. Phelps' terminology, a modality is a specific phase of treatment which is used exclusively for cerebral palsy conditions. There are fifteen modalities which make up the entire treatment for the five types, spastic, athetoid, tremor, ataxia, and rigidity. Each one will be described in full, giving the techniques Dr. Phelps employs.

- 1 Massage.
- 2 Passive motion.
- 3 Active assisted motion.
- 4 Active motion.
- 5 Resisted motion.
- 6 Conditioned motion.
- 7 Automatic or confused motion.
- 8 Combined motion.
- 9 Rest.
- 10 Relaxation.
- 11 Motion from the relaxed position.
- 12 Balance.
- 13 Reciprocation.
- 14 Reach and grasp.
- 15 Skills.



Fig. 3—Technicians at work in the Cerebral Palsy Department of the Children's Hospital, Buffalo, New York.

CHAPTER VIII

MASSAGE

When massage is given for any of the cerebral palsy conditions its main purpose is purely a basis for building up and increasing muscle power, by aiding the circulation and nutrition of individual muscles. This modality, massage, does not play too big a part in the treatment since few cerebral palsy muscles require it.

Spastic

A spastic muscle rarely needs massage due to the fact that the involuntary contractions occur often, causing the muscle to develop a greater amount of strength than is actually needed. However, its antagonist, the normal muscle, which seldom moves through the full range of motion, is considerably weaker and, therefore, requires massage for the purpose of building up the muscle tone. This build-up of the tone of the normal muscle equalizes the power of its antagonist, the spastic muscle. If a muscle and its antagonist are both spastic, no massage is needed, due to the fact that the muscle power is equalized.

There are some instances when it is advisable to massage a spastic muscle and, when this is so, the massage should be applied with great care in order not to cause *stretch reflexes anywhere in the body*. A deep kneading massage is the type that should be given whenever needed for cerebral palsy, always keeping the part in a relaxed position. When starting massage, if a stretch reflex is noticed in the muscle that is being massaged, or elsewhere in the body, the massage should be stopped and started again when the child is free of motion.

It is not a good plan to massage a muscle for the purpose of teaching relaxation since this method of train-

ing would be indirect. Dr. Phelps feels that the direct method of learning saves time and is more valuable to the child; anything that is taught does not have to be retrained for another purpose. This ideology is carried out with all phases of treatment.

Usually a spastic hemiplegia will require massage to the arm due to its lack of use. In most cases, the wrist flexors are spastic and the hand is, for the most part, held in a dropped position. Massage would be indicated to the opposing extensor group of muscles and can be applied in a lying or sitting position, depending upon the degree of the involvement. Greater degree of involvement would necessitate the lying position. Pillows may be used to correct and relax the part that is to be massaged.

All O.C. (zero cerebral) muscles require a considerable amount of massage, and it should be administered deeply and firmly for best results. The muscle must be held in its shortest position and not stretched. For instance, many times the dorsiflexors of the ankle are O.C. and when this area is massaged, the foot should be placed on a pillow and a flexed position of the ankle should be maintained. In this way, the dorsiflexors are held in a relaxed position and insured against any stretching.

Athetoid

For the most part, athetoids do not require massage. The muscles are usually kept nourished because of the contractions of the involuntary motions. Too, the athetoid has little or no fear and so makes every attempt to keep on the move. However, if there are any apparent weaknesses in the body, massage should be given. An athetoid child who is not able to walk has weakness of the quadricep muscle due to the constant sitting position. Massage would then be indicated for the quadricep muscle.

As was stated before, we only work in the direct way and, therefore, massage is not given to the athetoid to induce relaxation.

For the athetoid, massage is effective in balancing the nourishment of muscles and should be given as needed. Since time is an element and much training is necessary, only muscles that require it should be given massage.

Tremors

The motion is usually so rapid that the muscles are well nourished and the power balanced, and massage is not indicated.

Ataxia

The muscles of an ataxic child lack muscle tone and power. A good, stimulating, deep kneading massage is required for all parts of the body, which parts usually include the back and abdominal muscles. Regardless of the part that is to be massaged, all the muscles must be kept in a corrected and relaxed position. This is an important phase of treatment for the ataxic.

For all cerebral palsies, massage, if necessary, always precedes any other treatment that is to be given.

Summary

Spastic: Massage needed, not usually for the spastic muscles, but for their weaker antagonists. Massage needed for O.C. muscles found in these cases.

Athetoid: A relatively unimportant modality. Given in some cases for weak muscles.

Tremor: Massage rarely used.

Rigidity: Massage rarely used.

Ataxic: Important modality. The muscles of an ataxic need power and tone which is supplied by massage.

CHAPTER IX

PASSIVE MOTION

Passive motion is a modality that is always given for all cerebral palsy conditions and is used as a starting point of treatment, except for the comparatively few cases when massage is given.

The introduction to treatment by means of passive motion is as important to the trainer as it is to the child. The action of the trainer, who pictures for the child what his treatment is to be, will either increase tension on the child's part or will put him at ease immediately. The latter, of course, will aid and quicken the end result.

Passive motion is given entirely by the trainer with no help from the child and is of little value if given incorrectly. What is to be watched for in giving passive motion depends largely on the type of case being treated.

The application of this modality differs with each case since it has several purposes. It may be used for the nutritional value to the muscles, for training cortical pictures in the mind of a child who has never moved an arm or leg in its right manner, or for developing a kinesthetic sense. Regardless of what the cerebral palsy condition may be, motions require correcting, and treatment must first consist of showing the child how to make these motions with the parts of the body that are involved. This beginning must, therefore, be solely the work of the trainer in order that the child may know the correct motion.

A sense of timing is lacking with all cerebral palsies, which lack must be considered during all phases of treatment, but the groundwork for supplying the lack can be laid while giving passive motion. A timing that will

eventually be useful and ideal for physical activities should be one of the ultimate aims of treatment and, if it can be trained in from the start, it will save a considerable amount of time for the trainer. In order to obtain the timings for individual exercises, a metronome is used. It can be regulated for fast or slow rhythm, depending upon what is desired for the individual. A record can be kept and the metronome set for the same timing whenever desired. Generally speaking, the athetoid has to be slowed down while the spastic is a slow-moving child and has to have the motions speeded up. It can be seen how important timing is to the cerebral palsy child and how necessary to start training for it during this beginning modality.

Spastic

Passive motion means a great deal to a spastic child, especially if, before treatment, the child has been unable to move an arm or leg without having stretch reflexes occur. To begin in the right way, exercises must be given very slowly, to insure against stretch reflexes, and with as much range of motion as possible. While executing a particular passive motion, other parts of the body should be held in corrected positions to enable relaxation, thereby controlling any stretch reflexes.

Because of the spasticity in muscles not all motions can be put through the full range. When this is so it is perfectly satisfactory to start a motion within a small range and gradually increase it, so that, in time, the motion can be executed to the fullest range.

If the biceps muscle in the arm is spastic to a degree which limits the range of motion, it probably would be wise to start the flexion and extension of the elbow with the elbow held in a flexed position. The joint should be exercised very slowly, gradually increasing the range of motion, which slow increase will allow the trainer to work through the spasticity without the block of the stretch reflex. Exercises given to the spastic should be continued only when no stretch reflexes are felt. When

they are felt the exercise should be stopped. Even though spasticity never leaves a muscle, the child can learn to move the involved parts without causing a stretch reflex and, with training, can accomplish these motions with a considerable amount of speed.

In a great many cases, the spastic has marked tightness due to spasticity in the adductor muscles of the legs. This type of spastic assumes a habitual position, while supine, with the legs held tight together and, when placed in a standing position, the legs cross taking on a scissors gait. This should be treated by having the trainer hold the leg firmly in both hands, slightly elevated until the tension subsides sufficiently for the trainer to move it, slowly, in a very small range of motion. The spasticity diminishes under this treatment, making the motion easier to execute. It may take weeks, but gradually it will be discovered that the motion can be executed without too much thought being given to it and can be combined by exercising both legs reciprocally; this is the motion desired. All this is done passively with no help from the child and is carried out in the same manner, all over the body wherever needed.

Any braces when prescribed for a patient may be worn while exercises are given. They will aid greatly in correcting the direction of motion by maintaining the desired position of the part being exercised. The child also learns the proper function of the brace when it is manipulated passively. As treatment progresses, however, braces should be removed in order that the motions may be executed without their aid.

Passive motion also includes the act of stretching which is usually administered only to the spastic group since it is spasticity which lies directly in the muscles. This treatment can be given passively by the trainer, and the stretch maintained by a night brace which is created for the direct purpose of holding the muscle in its stretched position.

A spastic requires stretching when tightness is felt. The tightness is usually discovered in muscles that lack full

range of motion. The tightness can be due to a stretch reflex or to other causes. In some instances, even a normal muscle, when contracted, will be deprived of motion if it produces elsewhere in the body a stretch reflex. This is sometimes noticed when the leg adductors are spastic and the legs assume a scissors gait position. The internal rotators become tight from disuse. These rotator muscles, which are normal muscles, would then need specific stretching exercises and the stretching should be given passively by the trainer.

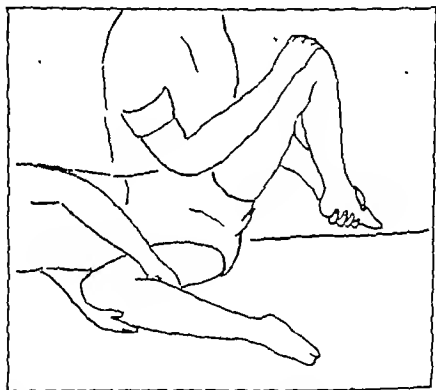


Fig. 4—Passive stretching to the internal rotators of the left hip.

Passive stretching should be given with extreme care and over a long period of time. The muscles should not be stretched at any one time beyond the point of tolerance. The stopping point can be made known by the child when pain is felt.

Any part of the body may be stretched passively but, as has been said, the stretching should be executed very

slowly and with frequent stops in order that relaxation will be maintained. No stretch reflex should be felt in the muscle being stretched or in any other muscle in the body. When stretched to toleration the part may be held in that position for a few counts and then brought back to the position directly opposite to that of the stretch. For instance, if an extensor muscle is stretched, the action should be completed by taking the part into complete flexion and the stretch started again, once more

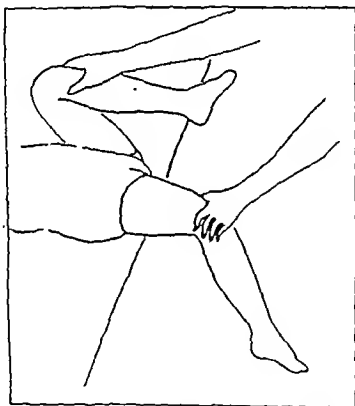


Fig. 5—Passive stretching to the right hip flexor.

stretching to tolerance. A stretch should be repeated from three to five times and, for the best results, given during each treatment.

For example, in order to stretch the gastrocnemius-soleus (knee flexed) the trainer's hand should be placed along the entire sole of the foot, making sure that the

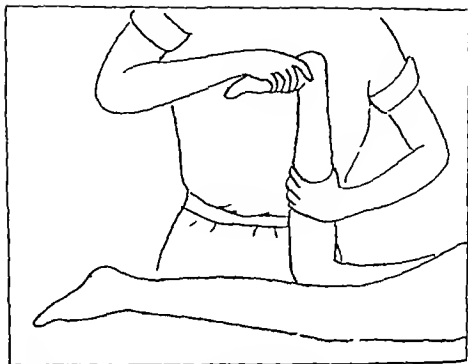


Fig. 6—Passive stretching to the gastrocnemius-soleus with patient prone.

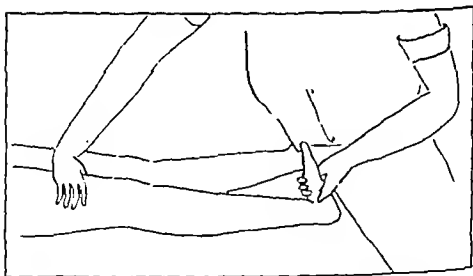


Fig. 7—Passive stretching to the gastrocnemius with patient supine.

stretch is placed on the heel cord. Then, very slowly and evenly, the trainer should flex the foot on the ankle so that the toes move toward the anterior part of the leg. When stretched to tolerance, the foot must be returned at the same rate of speed to a plantar flexed position. Gastrocnemius (knee extended) may be stretched in the same manner.

The spastic child who has a tight heel cord which requires passive stretching would benefit greatly if a night brace were worn. A short ankle brace is sufficient if the tightness is felt in the gastrocnemius-soleus but a longer brace is required if the gastrocnemius is tight. The brace should be constructed to allow increased motion to the dorsiflexors of the ankle.

Athetoid

Passive motion for the athetoid is given only after relaxation has been learned which latter will be discussed in a later chapter.

The athetoid has involuntary motions going on which interfere greatly with any desired motion due to the fact that every voluntary action attempted is steered in the wrong direction. An athetoid, therefore, must first learn to quiet these motions while in all positions before attempting any kind of voluntary motion. (See chapter on Relaxation, page 132).

When this has been learned passive motion may be tried. In a great many instances passive motion is started too soon for the athetoid, and, if it is discovered that the child is not yet ready for the progression, it should be stopped and relaxation training continued.

For all types of cerebral palsy conditions, training is begun with the large joints, progressing to the smaller joints, so that treatment is given proximally, working distally. It is of no value, for instance, if the hand is trained and the shoulder is so involved that the hand cannot be kept down at the side or near enough to the body to be of use. In the same way, it is useless for the

feet to be trained first if the hip is so poorly controlled that it will not allow the feet to touch the floor or to remain still for the purpose of standing or walking. Any phase of treatment for the arms should begin with the shoulders and progress to the elbows, wrists, and fingers only when there is a sufficient amount of control noticed in each preceding part. The training of the legs should start with the hips and progress slowly to knees, ankles, and finally to the feet.



Fig. 8—Exercise the hips with knees controlled by the application of extension cuffs.

Sandbags are used as an aid to treatment and should vary in size, shape, and weight. They should be made so that no weight rests directly on the body. (For construction see Apparatus and Equipment.) It is important that all other parts of the body remain quiet while the trainer is working on a specific extremity and, to assure this, sandbags are a necessity for those extremities which have not received treatment.

When the athetoid child is ready for passive motion, the trainer begins proximally and carries the extremity

through the full range of motion, in all directions, of which the joint is capable.

In order to exercise the hip properly the knee must remain straight, so the trainer's hands should be placed in a position maintaining extension of the knee with the leg held in good alignment to the body.

In some cases it is difficult to rule out the motions occurring at the knee which, in turn, produces a distorted action to the hip, regardless of how the leg is held. When this is so an extension cuff placed around the knee will rule out the involuntary motions to that joint, making the hip action more controlled. (For construction of extension cuff see Apparatus and Equipment.) The extension cuff is valued highly and is an important piece of equipment for the exercise training of the athetoid child. It is, however, important to remember that a child may learn to depend on aids and, as insurance against this, an exercise should always be repeated after the aid has been removed.

Timing by means of the metronome is as essential to the athetoid as it is to the spastic and should be introduced when giving passive motion treatment.

The importance of this modality with the athetoid is to give the child a picture of the correct direction of motions. All other parts should remain quiet while executing passive motion and the treatment should be stopped as soon as any excess motions appear.

Tremor

The tremor patient receives passive motion in the same manner as it has been described for the athetoid *after* relaxation has been learned. Sandbags and extension cuffs are used and are extremely helpful in diminishing the involuntary motions of the joints.

Treatment with the tremor patient should also start proximally, progressing to the distal parts of each extremity, and the parts that are exercised should be held firm-

ly in order to control the reciprocal action peculiar to the tremor.

Ataxic

The ataxic child is given passive motion directly after massage has been administered since relaxation training is not needed with this type of cerebral palsy.

The ataxic child lacks a kinesthetic sense, the feeling of muscular movement. Due to this fact the child must learn the correct direction for all motions. Passive motion is, therefore, important and is utilized to start the teaching of the ataxic child the position of his joints in relation to the rest of his body. Usually the ataxic child, when asked to bend the elbow, will hit his face in doing so and, when asked to straighten the elbow, will bring his hand down with such force that a noise occurs when the hand hits the treatment table. This is the sort of uncontrolled motion with which he has to contend. The ataxic also has the peculiarity of not completing motions he has started and can maintain fixed position of a part in mid-air for an indefinite length of time, much longer time than a normal child. He is not aware of these mistakes and they must be brought to his attention.

All the muscles involving an extremity may be treated in the course of a treatment period and should be started proximally, working toward the distal end. Again, the extremity should be carried through the full range of motion, in all directions of which the joint is capable. Because the ataxic child is not troubled with excess involuntary motions, more exercising can be accomplished in a treatment period than with the athetoid or tremor patient.

The value of passive motion to an ataxic is that he obtains a cortical picture through the passive joint manipulation

Summary

- Spastic:* Highly important for teaching smooth motions in the extremities without the disturbance of stretch reflexes.
- Athetoid:* Not primary in importance. Follows relaxation training.
- Tremor:* Same as athetoid.
- Ataxic:* Important for teaching the kinesthetic sense which the ataxic lacks.
- Rigidity:* Same as spastic except for a faster rate of speed.

CHAPTER X

ACTIVE ASSISTED MOTION

Active assisted motion follows passive motion and is given only when the child is ready for the progression. When active assisted motion can be used for training the arms and legs, it should be preceded by passive motion and graded gradually into active assisted motion. This treatment should always be given in this manner.

Athetosis and spasticity become stimulated upon using this kind of motion and, as a result, involuntary motions and stretch reflexes should be watched for very closely. If seen, the motion should be stopped and exercises should be continued by the use of passive motion until the trainer thinks active assisted motion can be tried again. The training will not prove beneficial to the child unless each motion is properly trained before attempting an added motion. The child should progress only when ready and should not be hurried in any way.

Active assisted motion is given by the trainer with a small degree of help from the child. Up to this time in the training of the cerebral palsy child, the child has not helped with the actual function of the muscle. With this modality he begins.

With active assisted motion it must be kept in mind that gravity exerts a force on muscles and can be used as a form of assistance. It depends upon the position of the child whether or not assistance is given by means of gravity. Use the knee as an example. If the child is in a side-lying position gravity becomes neutralized and no assistance is given to knee flexion. In a prone-lying position knee flexion is performed against gravity which produces a resisted motion. The trainer should be aware of all existing gravitational changes that occur with muscles

and should place all of the joints of the body in the correct position to insure the desired activity of the motion.

Before starting active assisted motion it has been stated that the child must learn complete control during passive motion. However, it is not necessary to wait for complete control of the entire body before starting this phase or any new phase of treatment, just so long as the specific muscle being treated is controlled enough to warrant progression. After treatment has been given for a time and some progression has been allowed, the trainer will probably be giving varied types of motion all over the body. This is true with all cerebral palsy conditions.

Spastic

The spastic child usually presents a problem which is detected while giving the exercises using active assisted motion. The slight help that the child gives brings on normal overflow as well as stretch reflexes. All excess motions should be stopped or else active assisted motions will be of no value. Normal overflow may occur anywhere in the body and is involuntary in nature. The child's attention may be brought to the part, repeatedly, so that overflow can be trained out voluntarily by him. For instance, if a child dorsiflexes an ankle every time the arm is raised with active assistance, the trainer should point out this excess motion and the child should be made to concentrate on performing the arm motion while maintaining control to the ankle. If this cannot be controlled voluntarily it is a good plan to rule out the overflow by placing a heavy enough sandbag on the ankle to make it impossible for the motion to take place. Overflow is a condition that is a hindrance to voluntary movement and should be ruled out as early as possible to assure better results from training.

It may be discovered that active assisted motion may limit the range of motion desired due to stretch reflexes. If this is so, the motion should be started with a small range and gradually increased until the part can be exercised fully.

Leg exercises may be given very effectively by the use of weighted pulleys, provided there are no stretch reflexes present. The pulleys can be constructed over the treatment table so that the child is able to lie in either a supine or prone position while receiving the exercises. The weight of the pulleys can vary depending upon the exercise and amount of assistance required. The pulleys are helpful because the direction of motion can be steered correctly. The weights can be decreased as the child learns more control, the decrease being a positive sign of progression to the trainer. This also changes the routine of treatment enough to keep the child from being bored.

Active assisted motion is an important modality for the child and the trainer. It not only is the starting point of self movement, but it reveals faults that do not appear during passive exercising.

Athetoid

It usually takes a considerable amount of training before the athetoid is ready to attempt even a minimum amount of voluntary motion. However, when passive motion can be given without interruption by involuntary motions, the trainer should progress gradually to active assisted motion and let the child help a little with each motion. If any excess motions appear, the exercise should be stopped. The athetoid has had previous training in relaxation and it must be maintained, once learned through all other modalities.

Extension cuffs, which have already been explained under passive motion, may be applied for active assisted motion. The main problem with an athetoid is the steering and direction of his motions. This active assisted motion, therefore, is extremely important because it helps the child picture more clearly what he has to learn to make a correct motion.

The trainer will also discover through this modality that an athetoid will try to use controlled substitute muscles in place of the desired uncontrolled muscles. This



Fig. 9 Weighted pulleys aid in progressing to active motion by decreasing weights.

must be watched for very carefully and if so, passive motion may have to be utilized again to correct it.

The final rate of speed reached for individual motions during passive motion may have to be decreased when starting active assisted motion. It might best be said here that this is true when starting *any* new phase of treatment. If a metronomic timing is kept from the beginning when treatment is started, less time is wasted in securing the proper tempo to be used as a starting point for all future modalities. It is usually the first timing recorded that is desirable for each succeeding modality. Each one is started and increased at the same rate of speed as the first modality timing.

Tremor

The problems arising with the tremor are similar to the athetoid and both are treated in the same manner. In some cases, the tremor has so much involvement, due to the wide swing of involuntary motion, that it takes considerable treatment time and patience with relaxation and passive motion first before arriving at this modality. When the tremor child is ready to give some help to the motion, he is quite advanced.

Ataxic

The ataxic child usually works into active assisted motion more readily than the spastic or athetoid. When starting active assisted motion, regardless of the control the child may have, it is advisable to begin each time with passive motion and grade it gradually into active assisted motion.

The direction, speed, and range of motion are the most important factors with the ataxic and these faults appear to a large extent upon the introduction of active assisted motion. It is the slight help to the muscle on the child's part which upsets the controlled picture previously seen during passive motion. If this is so, passive motion should again be given until the time when active assisted motion may again be introduced.

The timing of each exercise, the rhythm, is important and should be started for active assisted motion in the same manner in which it was started for passive motion. Because the ataxic is a slow-moving child, motions must be speeded up in order to train him in activities that will be useful. Unless this timing is speeded up in the early stages of treatment, it will be difficult for the child to learn new habits later on. When timing is not accentuated, it has been found in a number of cases that the child has learned control but to no purpose. For instance, the child may learn to dress and undress himself fully without assistance, but it may take him all day to complete the activity. Therefore, the training has been unsatisfactory and useless.

An ataxic also derives considerable benefit from the use of weighted pulleys for the arm and leg exercises. The weights act as the assisting element which gives the child a better sensation of the motion being executed. However, the use of the pulleys should be lessened gradually so that the arms and legs can eventually be exercised without aids of any kind.

This modality is important to the ataxic, since it teaches him to control the direction of the motions.

Summary

Spastic: Progression which follows passive motion. Requires more concentration and control in muscles. More likely to observe stretch reflexes. If stretch reflexes are found, treatment too advanced.

Athetoid: Advanced stage of treatment for the athetoid. Athetosis may become stimulated; this must be watched for. If athetosis or overflow is noticed, treatment too advanced.

Tremor: Same as athetoid.

Ataxic: Active assisted motion is reached more readily with the ataxic, and teaches direction, speed, and range of motion.

Rigidity: Same as spastic.

CHAPTER XI

ACTIVE MOTION

The child who is capable of doing active motion is capable of maintaining a considerable amount of control throughout the body. This modality should only be administered if control can be mastered during voluntary motions, regardless of the type of cerebral palsy. Active motion is one of the last phases in the training period for any of the five types, spastic, athetoid, tremor, ataxia, and rigidity.

This modality is executed entirely by the child receiving training and no outside manual help is given. The trainer merely directs the desired motion by counting, which count regulates the range of the motion and the speed that is desired for the activity. The metronome may be used for keeping the trainer's count correct and for maintaining accuracy of the count each time the exercise is given. As mentioned before, in explaining previous modalities, active motion will also start with a slow rate of speed increasing gradually to the ideal timing for each individual motion.

The trainer's main role during active motion is to observe keenly all the parts of the body for any irregularities that may occur. If seen, these must be ironed out at this time.

Active motion is started only after active assisted motion has been learned properly and, when started, should be stopped immediately if any involuntary motions of any type are noticed. As has been mentioned before, this is essential if the child is to have the best results possible from training. Being painstaking with the control of motions may seem at times to slow up the training process, but, in the end, it will be of more value to the child.

It must be remembered by the trainer that control has to be carried over to activities outside the treatment room and the child must retain this control regardless of the circumstances under which he may have to act. If it is discovered, then, that the child is not ready to progress to this modality, active assisted motion should again be stressed.

The motion should be started passively, graded to active assisted motion and finally to active motion for all types of cerebral palsy when giving any of the exercises to the arms or legs.

Not all the muscles in an extremity will receive the same type of motion during treatment. The treatment will depend on the degree of control found with the individual muscle.

True active motion should be executed without the help or resistance of gravity and, to assure this, proper position of the child during the individual muscle actions should be sought. Since gravity affects practically every motion of the body it must be watched carefully. For instance, if the child is doing elbow flexion and extension while lying in a supine position, the bicep muscle becomes overworked and the tricep is not put to use at all. The bicep, while in this position, will contract to bring about flexion and will remain in a contracted position for extension. If the bicep were not held contracted, the hand would fall to the bed through the force of gravity. Therefore, in order to bring about the action of the tricep muscle for the act of extending the elbow, the arm should be placed in a neutral plane which, in this case, would put the child in a side-lying position.

Any appliances used for previous motions may be applied for active motion at the beginning of the training period but should gradually be removed so that the arms and legs will eventually move without aids of any kinds.

In most cases when the child has learned the technique of the active motion, and is capable of maintaining control during this phase of treatment, it can be assumed that he has completed his fundamental training and is ready

for complicated natural acts that occur in his everyday routine.

Spastic

The importance of this modality for the spastic is to teach him to use the muscles at a useful rate of speed. It takes a considerable amount of training for him to reach this phase of treatment, and it can only be given when the control of stretch reflexes and overflow can be maintained during voluntary actions.

Since spasticity lies directly in the muscles, stress should be placed on the actual function of the muscle, never forgetting that gravity must be eliminated to get correct active motion.

The starting rate of speed must be slow, as in all other modalities, and the speed must be increased gradually to the timing that the child will use in everyday activities. Emphasizing the importance of this final timing will produce a carry-over to activities used outside the treatment room, and the child will eventually learn to use it for acts such as dressing and undressing.

Appliances, such as braces and extension cuffs, may be used for active motion, but should be removed gradually until all the motions can be executed without aids of any kind.

Active motion is one of the final steps given to the spastic child, so, I repeat, it is most important to make certain that proper control can be maintained during all voluntary motions of the arms and legs. The carry-over from the motions, as well as the timing of them, will assure the proper motions for all outside activities.

Athetoid

A long training period must be given to the athetoid also, before he attains the proper amount of control to warrant receiving active motion. This is, for the most part, the concluding phase of treatment. It takes in all

the aspects of motion, under supervision in the treatment room, that the child will use for activities that occur in a day's routine of living.

Every motion started must be gradually brought through all modality steps, all excess motion must have been eliminated, gravity also eliminated as a resisting or assisting factor to the exercise, and the emphasis of the trainer should be on accurate direction and range of motion and on timing.

All appliances, sandbags, extension cuffs, pulleys, braces, may be used, but should be removed gradually as the part becomes more controlled and can function without aids.

The child should be given the exercises in all lying positions, as previously stated, to assure proper motion of all joints.

Active motion is as important a modality for the athetoid as for the spastic because it is one of the last phases of his treatment also. If learned properly, he will use it as preparation for the motions needed in performing useful activities.

Tremor

The tremor child is given active motion in the same manner as the athetoid. The problems that occur are similar, are handled in the same way, and all involuntary motions must be controlled before executing it. The emphasis is, similarly, on correct direction of motion and timing.

Ataxic

The ataxic case is quite different. This modality may be said to be a basic phase of training since a large part of the treatment remains to be given. Active motion must be learned very thoroughly, therefore, in order to obtain the best results from Dr. Phelps's technique.

While executing this modality, the atoxic child must learn to move the arms and legs in the desired directions without the help of the eyes. The atoxic, in learning a kinesthetic and tactile sense, uses the eyes to a great degree for guiding all the motions of the body. When a child is ready for active motion, the trainer stresses direction and range of motion and timing, first with the eyes open and then with them closed. By ruling out the use of the eyes the kinesthetic and tactile sense becomes more highly developed.

The motion should be started passively, gradually worked through active assisted motion to active motion. The goal toward which the trainer works is a smoothly executed and accurately timed motion.

Summary

Spastic: Treatment quite advanced for spastic. Speed and range of motion stressed.

Athetoid: Concluding stage of treatment for preparation for performing future useful activities.

Tremor: Same as athetoid.

Ataxic: Highly important for future training of the atoxic. Direction and timing of motions stressed with and without the use of the eyes.

Rigidity: Same as spastic.

CHAPTER XII

RESISTED MOTION

Resisted motion will be discussed generally for the five types of cerebral palsy, spastic, athetoid, tremor, ataxic, and rigidity, because it is not always given as a form of treatment. It is important to understand resisted motion, however, so that the trainer will know when and how it may occur, when it should be eliminated and when it should be used.

Resisted motion is a type of force put against the desired motion causing a slowing-up of the motion. It can occur inadvertently through the use of wrinkled sheets, uneven mattresses, illadjusted appliances, et cetero. Obviously, this should be avoided. For instance, when a child moves part of his body voluntarily against a wrinkled sheet he is required to use an added amount of strength to carry out the desired motion. This may cause involuntary motions that are not wanted. A very soft treatment mattress which becomes sunken due to the weight of the child's body may produce a resisted motion when the child performs the simple act of spreading the arms or legs to the side. This again, requires the child to use an added amount of strength in order to move. Appliances, such as braces, may not move freely for lack of oil, causing added exertion on the child's part to make them function properly.

On the other hand, resisted motion can be used manually by the trainer as an intended phase of the treatment. In order to produce resisted motion the trainer should place her hand in such a way as to cause pressure against the part of the body that is being exercised actively by the child. For instance, if manual resistance is desired to the tricep muscle in the arm, it may be produced by pushing against the forearm while the elbow is being straightened. The resistance put on the triceps muscle

will slow up the motion. The degree will depend upon the amount of resistance that the trainer applies to it.

Resisted motion is used in the final stages of muscle re-education for the purpose of securing the maximum amount of power for the particular muscle that is being trained.

Since the spastic muscle is too strong a muscle, resistance has no value and is not given to it. As a matter of fact, just the opposite is true. The stretch reflex produces resistance which is not desirable and it has to be *eliminated* when treatments are first started. However, in a great many instances, when the spastic child reaches the last phases of training, stress is placed on obtaining power, to the last degree of a muscle action. In order to accomplish this, manual resistance may be given to the antagonist muscle.

For instance, the vastus medialis which straightens the knee the last few degrees, is often weak, especially if the child has been a chair sitter for any length of time.

If this particular muscle is weak and cannot perform its function, it should be educated. This can be done by applying manual resistance to the muscle, thereby causing a greater amount of exertion on the child's part to bring about the desired action. The resistance should first be applied while the child is lying on his side with gravitational force eliminated. When the motion satisfies the trainer, the child can then progress to sitting over the edge of the table. The motion is then performed against gravity as the resisting force, the same force which he will have to resist when walking.

This muscle re-education may be needed in other parts of the body and the trainer should give it always as one of the last phases of the treatment, when stretch reflexes and overflow have been eliminated.

For the spastic child who has O.C. (zero cerebral) muscles, resistance is a necessary form of training and is the only way these inactive muscles can be made to work again. This training is a subject in itself and will

be taken up later in the modality, Automatic or Confused Motion.

The athetoid and tremor seldom require resisted motion since the involvement lies in the joint rather than in the muscle. However, sometimes manual resistance may be applied in order to bring about a specific picture of a muscle action. The athetoid moves involuntarily and does not always know when certain motions are made. If resistance is applied at this time, the athetoid can feel the muscle contraction more clearly. It has no purpose other than to clarify the feeling of the muscle action during involuntary motion.

The ataxic child must increase his muscle power. In order to do this, resistance is applied generally all over the body wherever there is muscle weakness. It is given in the same manner which has been discussed for the spastic and only after the motions can be executed properly during active motion. As with the spastic, the exercises should begin with the resistance applied manually and should progress to the point where gravity becomes the resisting factor.

It must be remembered that resistance may increase athetosis and stimulate spasticity. It should only be administered when needed, and should be stopped immediately if any excess motions appear anywhere in the body. It can be extremely dangerous if applied incorrectly and it should be executed with the greatest care.

Summary

- Spastic:* Employed for strengthening muscle power in muscles antagonistic to spastic muscles, as well as to muscles weakened by nonuse. Important to the treatment of O.C. muscles.
- Athetoid:* Helps to clarify a specific picture of a muscle action in relaxation treatment. Given for muscles weakened by nonuse.
- Tremor:* Rarely used. Similar to athetoid.
- Ataxic:* Important to ataxic since all muscles need increasing muscle power.
- Rigidity:* Same as spastic.

CHAPTER XIII

CONDITIONED MOTION

The theory of conditioning was first suggested by Pavlov, who did an amazing experiment on a dog. The experiment was started by placing a piece of meat between the dog and a wire mesh. Pavlov would then ring a bell and, at the same time, give the meat to the dog. After a few such trials, he noticed that the dog drooled as soon as the meat was placed before him. After several months of this training procedure saliva would run freely in the dog's mouth whenever the bell rang, even though there was no meat in sight. As a result of this finding, the conception of conditioning was formed. Since a reaction finally took place every time the bell rang, the dog had become conditioned to the bell. Pavlov then attempted to broaden the stimulus by ringing a different toned bell and carried on until the dog reacted finally to noises. According to this theory of Pavlov's a stimulus and a reaction must be present in order to train a true form of conditioning. In his experiment, the bell was the stimulus and the saliva in the mouth of the dog the reaction.

A human being may also become conditioned by progressing from a real stimulus to an artificial one.

Conditioning has been used successfully in training cerebral palsy children. (Conditioning is a psychological tenet which, when used in combination with the modalities of motion, produces the desired physical reaction, the correct motion). For this purpose there is a standard rhyme set to music for every motion of the body. The conditioning is started when the trainer begins passive motion. If combined correctly with passive and active assisted motion the child will automatically perform the corresponding motion every time a rhyme is heard when he reaches the stage of active motion.

The first person who treated cerebral palsy children, Miss Jenny Colby, started the work in 1883. Miss Colby was a graduate of the Perkins Institute. Of the many things she contributed were the rhymes now used in the treatment. She died in the year 1918 but these same rhymes are used today universally wherever cerebral palsy children receive training. Because of this universality a child starting treatment in one place will be able to carry on with the training if moved to another locality without too much interruption.

The trainer must learn the rhymes and give the necessary ones each time the child is exercised, making sure that the words of the rhymes always appear at the same point of action in a given exercise. For true conditioning each exercise must start and proceed in the same manner each time it is given.

Upon starting, the child should always be placed in a lying position which assures the maximum amount of control to all parts of the body. The trainer, when giving manual help, should take hold of the part being exercised in such a way that the shifting of hands is eliminated. Hand changing causes an interruption to the rhythm and makes the motion less smooth.

The spastic, athetoid, tremor, ataxic, and rigidity utilize the same exercises for the arms and legs when the child is ready for it. The only distinction is the period of training at which the conditioning is given the different types. For all types the motions are started proximally with the shoulder or hip, progressing distally to the fingers or toes. When considering the arms, it is important to perform the simple joint motions first and not combinations of joint movements, until the individual motions are learned or are far enough advanced to make combined motions advisable.

Exercises to the arms and legs may be given singly or by reciprocal action. If exercised singly one extremity is trained separately and the trainer begins to sing the rhyme at the start of the motion.

CHAPTER XIII

CONDITIONED MOTION

The theory of conditioning was first suggested by Pavlov, who did an amazing experiment on a dog. The experiment was started by placing a piece of meat between the dog and a wire mesh. Pavlov would then ring a bell and, at the same time, give the meat to the dog. After a few such tries, he noticed that the dog drooled as soon as the meat was placed before him. After several months of this training procedure saliva would run freely in the dog's mouth whenever the bell rang, even though there was no meat in sight. As a result of this finding, the conception of conditioning was formed. Since a reaction finally took place every time the bell rang, the dog had become conditioned to the bell. Pavlov then attempted to broaden the stimulus by ringing a different toned bell and carried on until the dog reacted finally to noises. According to this theory of Pavlov's a stimulus and a reaction must be present in order to train a true form of conditioning. In his experiment, the bell was the stimulus and the saliva in the mouth of the dog the reaction.

A human being may also become conditioned by progressing from a real stimulus to an artificial one.

Conditioning has been used successfully in training cerebral palsy children. (Conditioning is a psychological tenet which, when used in combination with the modalities of motion, produces the desired physical reaction, the correct motion). For this purpose there is a standard rhyme set to music for every motion of the body. The conditioning is started when the trafoer begins passive motion. If combined correctly with passive and active assisted motion the child will automatically perform the corresponding motion every time a rhyme is heard when he reaches the stage of active motion.

The first person who treated cerebral palsy children, Miss Jenny Colby, started the work in 1883. Miss Colby was a graduate of the Perkins Institute. Of the many things she contributed were the rhymes now used in the treatment. She died in the year 1918 but these same rhymes are used today universally wherever cerebral palsy children receive training. Because of this universality a child starting treatment in one place will be able to carry on with the training if moved to another locality without too much interruption.

The trainer must learn the rhymes and give the necessary ones each time the child is exercised, making sure that the words of the rhymes always appear at the same point of action in a given exercise. For true conditioning each exercise must start and proceed in the same manner each time it is given.

Upon starting, the child should always be placed in a lying position which assures the maximum amount of control to all parts of the body. The trainer, when giving manual help, should take hold of the part being exercised in such a way that the shifting of hands is eliminated. Hand changing causes an interruption to the rhythm and makes the motion less smooth.

The spastic, athetoid, tremor, ataxic, and rigidity utilize the same exercises for the arms and legs when the child is ready for it. The only distinction is the period of training at which the conditioning is given the different types. For all types the motions are started proximally with the shoulder or hip, progressing distally to the fingers or toes. When considering the arms, it is important to perform the simple joint motions first and not combinations of joint movements, until the individual motions are learned or are far enough advanced to make combined motions advisable.

Exercises to the arms and legs may be given singly or by reciprocal action. If exercised singly one extremity is trained separately and the trainer begins to sing the rhyme at the start of the motion.

Reciprocal exercises are usually preferred since there are few activities that require the use of one hand or one leg. When exercises are given reciprocally, both arms or both legs are moved at the same time but in opposite directions. For instance, for the reciprocal action of elbow flexion and extension the hand is placed so that it touches the shoulder with the elbow flexed. The reciprocal action begins when the other hand is raised in the same manner at the same time that the raised hand is lowered. In this way both hands move but in opposite directions, one going up while the other comes down.

One side of the body always leads and the other side assists. Therefore, the child who is right-handed uses the right hand as the leading one and the left-handed child is trained with the left hand leading. Handedness of the child should always be known before starting the exercises.

The rhyme is started when the leading side of the body begins to act.

Best results from treatment will result if the child is able to watch the exercises being performed. In order to make this possible, mirrors should be used for all phases of training. A mirror placed on the ceiling over the treatment table allows the child to watch his motions while in a supine position. The cerebral palsy child who sees the parts being moved acquires a clearer picture of the desired action and is therefore, better able to accomplish a conscious learning of the activity.

As soon as the child can maintain proper sitting control the arm exercises should be given in a sitting position and the ankle and toe exercises given with the child's legs hanging over the edge of the table.

Appliances, such as braces, extension cuffs, sandbags, pulleys, et cetera, may be used as described in preceding chapters. This modality is combined with passive and active assisted motion to get a proper and automatic active motion. A polished board which has not been mentioned before, is used for leg exercises and is ex-

trremely helpful in getting a smooth motion. It is a thin board, approximately twenty-four by thirty-one inches, and when used should be placed on the treatment table with the legs resting on it, the child in a supine position. It should be thin enough that it will not hold the hips in a flexed position. Powder sprinkled on it eliminates all resisting factors and the exercises are performed with greater ease.

In starting pure conditioning exercises for the child who has never had exercises before, the trainer should begin by giving the following simple joint motions.

Arm Exercises

Shout the Rocket	supine	Forward flexion of the shoulder
	prone	Backward flexion of the shoulder
Pump the Water	supine	Internal and external rotation of the shoulder
Sunbeams Rise and Fall	supine	Abduction of arms
	prone	Abduction of arms
Up and Down	supine	Flexion and extension of elbow
Roll Over and Over	supine	Supination and pronation of forearm
This Way That Way (weather vane)	supine	Flexion and extension of wrist
	sitting	
Little Bristles	supine	Flexion and extension of the fingers
	sitting	
Thumbkins and Pointer	supine	Finger and thumb opposition
	sitting	

Leg Exercises

Gallop Trot*	supine	Combination of hip, knee and ankle flexion
One Two Button Your Shoe	supine	Leg abduction and adduction
Yankee Doodle	prone	Knee flexion and extension

*Gallop Trot is the only combined motion given at the start of the training and the reason for giving this is that it is impossible to give knee flexion without giving hip flexion. Its action is the same as that used in walking. Since it is the chief motion for the legs it should be stressed as early as possible if the child is to walk eventually.

After the above exercises have been mastered and can be executed with proper control add the following in the training of the child.

Arm Exercise

Grind the Coffee	supine	Combination of shoulder internal and external rotation with elbow flexion and extension
------------------	--------	---

Leg Exercises

Shoot the Rocket	supine	Hip flexion
	prone	Hip extension
Roll Over and Over	supine	Internal and external rotation of the hips
Up and Down	supine	Dorsiflexion and plantar flexion of the ankle
	sitting	
This Way That Way (weather vane)	supine	Inversion and eversion of the foot
	sitting	
Little Birdies	supine	Flexion and extension of the toes
	sitting	

Walking Exercise

Bobby Shafto	High knee bend and foot placement
--------------	-----------------------------------

Conditioned motion should be administered with great care. It is the work of the trainer to observe and correct any abnormalities that arise. This modality is given to the athetoid after the technique of relaxation has been learned and should be stopped if involuntary motions appear. Spastics should be watched closely for the appearance of stretch reflexes and overflow. For the ataxic it is the chief form of training and is beginning treatment.

The important factor in training cerebral palsy children in motion is to teach them to move their arms and legs properly. Conditioning through the modalities of passive and assisted motion will result in the desired reaction when the child reaches the advanced stage of active motion. That reaction is an automatic, controlled motion.

Children, up to the age of ten or thereabouts, will learn the rhyme rather than the motion and associate the rhyme by carrying out the corresponding activity. However, as the child grows older, he automatically executes the exercises by moving each part at command rather than by the rhyme. There is an advantage in beginning the conditioning when the child is very young and before he has acquired bad habits of tensing and tightening muscles.

An interesting example is that of a child who started conditioning training at the age of two. When she was eight years old she was sitting reading a comic magazine while waiting for her treatment period to begin. A trainer, seeing her absorption in the magazine, started to sing the rhyme, "Little Birdies in Their Nest." The child, without taking her eyes from her reading, started the motion of closing and opening the hand which is the corresponding exercise for "Little Birdies."

The rhymes can be used beyond the conditioning age as a means of inducing rhythm into the exercises and for the purpose of suggesting the range of motion desired.

Following are the conditioning exercises with their corresponding rhymes.

Arms

1. Shoot the Rocket

supine Forward flexion—shoulder

Place arms down on the bed at the sides of the body, with the open palms turned inward. Keeping elbows straight, bring the assisting arm up and carry it over the head until it lies close to the ear, palm facing inward. Begin the exercise by raising the leading arm in the same manner while lowering the raised arm down to bed until it assumes the original position. Both arms move at the same time but in opposite directions.

prone Backward flexion—shoulder

With the open palms facing inward toward the body, raise the assisting arm upward in a straight line ten to twelve inches. Begin the exercise by raising the leading arm in this manner while lowering the raised arm to bed. Arms should move at the same time but in opposite directions. Elbows should be in an extended position during the entire exercise.



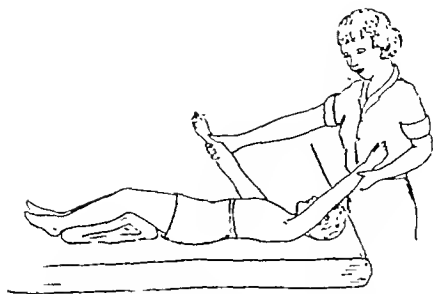


Fig. 10—"Shoot the Rocket," with patient supine.

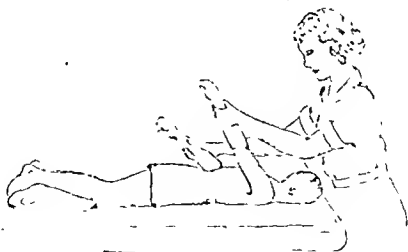


Fig. 11 "Shoot the Rocket," with patient prone.

2. Pump the Water

supine Internal and external rotation—shoulder

This exercise is usually given singly, one arm at a time. Place the arm out to the side at shoulder level with the elbow flexed at a right angle. The open palm should face in the direction of the feet. Begin the exercise by externally rotating the shoulder, bringing the back of the hand down to the table in the upward direction of the head. Carry it in the opposite direction into internal rotation until the open palm rests on the table, in the downward direction of the feet. The elbow should remain firmly fixed in one position on the table during the entire exercise.



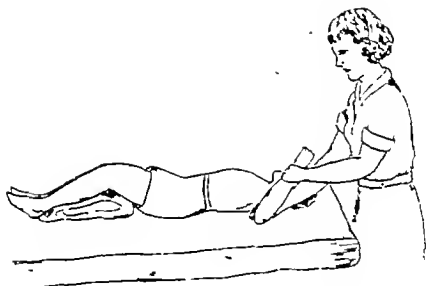


Fig. 12—"Pump the Water," with patient supine.

8. Sunbeams Rise and Fall supine Abduction and adduction—
arms

Place arms down on the bed at the sides of the body with hands turned inward. Keeping the elbows straight, slide the assisting arm on the bed upward and continue the motion by carrying the arm over the head level until the arm lies close to ear. Begin the exercise by raising the leading arm in this same manner while lowering (following the same pattern) the raised arm down to bed until it assumes original position. Both arms move at the same time but in opposite directions.

prone Abduction and adduction—
arms

With the open palms facing inward toward the body, slide the assisting arm out to the side up to the shoulder level. Externally rotate the shoulder and continue the motion until the straight arm is over the head resting next to the ear. Begin the exercise by raising the leading arm in this same manner while the raised arm is lowered (following the same pattern) until it assumes original position. Both arms move at the same time but in opposite directions. Elbows should be in an extended position for the entire exercise.



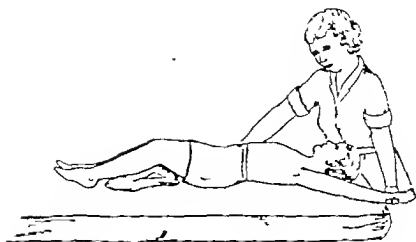


Fig. 13—"Sunbeams Rise and Fall," with patient supine.

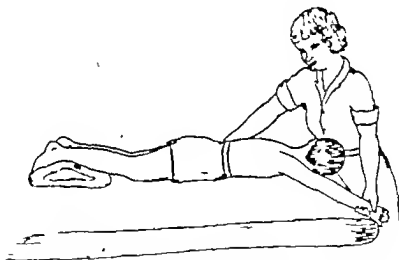
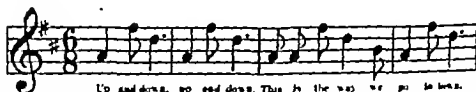


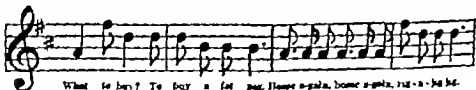
Fig. 14—"Sunbeams Rise and Fall," with patient prone.

4. Up and Down supine Flexion and extension — elbow

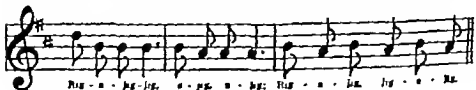
Place arms down on bed at the sides of the body with the open palm facing the ceiling. Bend the assisting elbow until the open palm touches the shoulder. Begin the exercise by bending the leading elbow in this same manner, while lowering the already raised hand down to the bed until it assumes original position. Both elbows are exercised at the same time but in opposite directions. Elbows should remain firmly placed in one position on the table throughout the entire exercise.



Up and down, up and down, This is the way we go to town.



What to buy? To buy a fat pig. Home a-gain, home a-gain, rag-a-bag-bag.



Rag-a-bag-bag, a-pig, a-bag; Rag-a-bag, rag-a-bag.

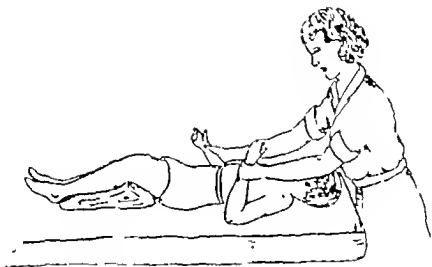


Fig. 15—"Up and Down," with patient supine.

5. Roll Over and Over

supine Supination and pronation—
forearm

Bend both elbows slightly with the open palms facing the shoulders. Turn the assisting forearm until the open palm faces in the direction of the foot of the bed—this is a pronated position. Begin the exercise by pronating the leading forearm while the assisting forearm turns back to a supinated position. Both forearms turn at the same time but in opposite directions. Elbows must be held in slight flexion for true forearm supination and pronation.



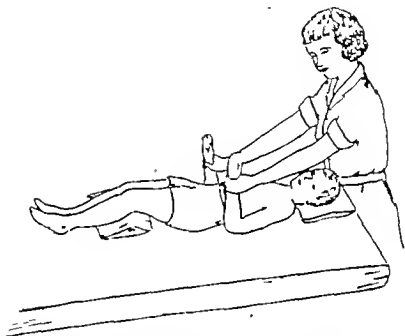


Fig. 16—"Roll Over and Over," with patient supine.

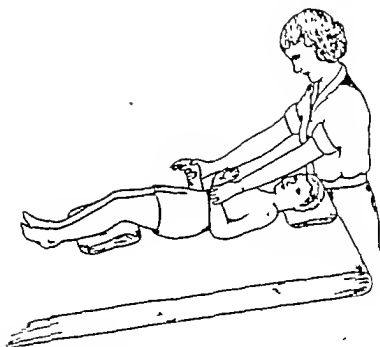
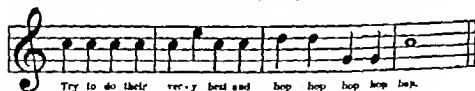
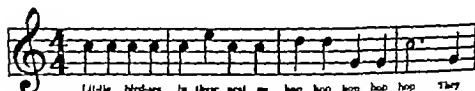


Fig. 17—"This Way, That Way," with patient supine.

7. Little Birdies

supine Flexion and extension—fin-
sitting gers

Bend both elbows to right angles with the open palms facing the shoulders. Make a fist with the assisting hand by closing the fingers (thumb outside). Begin the exercise by making a fist of the leading hand while opening wide the already closed hand. Both hands move at the same time but in opposite directions. Elbows should remain firmly placed in one position throughout the entire exercise.



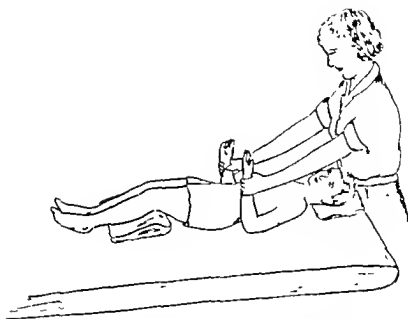


Fig. 18—"Little Birdies," with patient supine.

8. Thumbkins and Pointer supine Finger and thumb opposition
sitting

The back of the hands may rest either on the table or may be open, facing the shoulders with the elbows flexed at a right angle. Place the tip of the Index finger to the tip of the thumb with the assisting hand. Begin the exercise by doing this same motion with the leading hand while opening wide the already closed fingers. Continue by having the middle finger touch the tip of the thumb and proceed with the remaining fingers. The fingers should touch the thumb at the tip and the hand should open wide between each motion. Each finger touches the thumb four times before going on to the next finger.



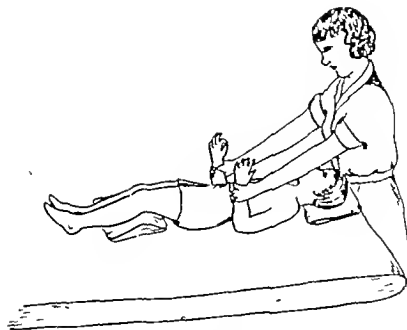


Fig. 19—"Thumbkins and Pointer," with patient supine.

Leg Exercises

1. Gallopy Trot

supine Flexion and extension—knee,
hip, ankle

Bend the assisting knee upward so that the back of the heel is near the buttock on the same side of the body. Begin the exercise by raising the leading leg in this same manner while lowering the already raised leg down on table until it assumes the original position. Both legs should move at the same time but in opposite directions. The legs should travel in a straight line.

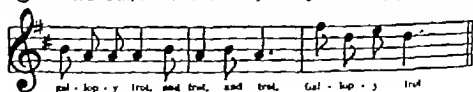
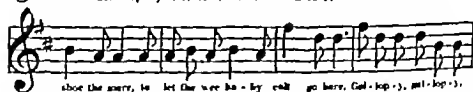
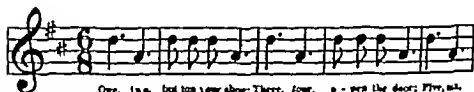




Fig. 20—"Gallopy Trot," with patient supine. Polished board
Under legs allows smoother action.

2. One, Two, Button Your ^{supine} Abduction and adduction—
Shoe ^{legs}

Begin the exercise by spreading the legs apart and then together again. Both legs should start and finish at the same time. Avoid internal and external rotation and maintain knee extension throughout the motion.



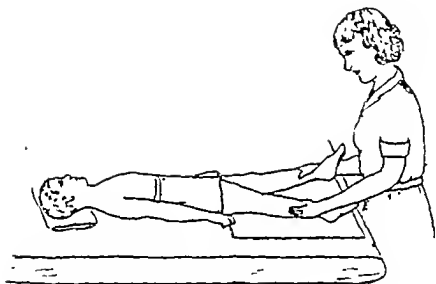
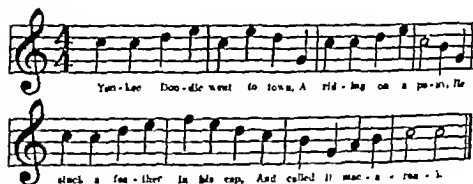


Fig. 21—"One, Two, Button Your Shoe," with patient supine.
Legs move freely on polished board.

3. Yankee Doodle

prone Flexion and extension—knee

Bend the assisting knee so that the heel touches the buttock on the same side of the body. Begin the exercise by flexing the leading knee while the already flexed knee is lowered down to bed. Both legs should move at the same time but in opposite directions.



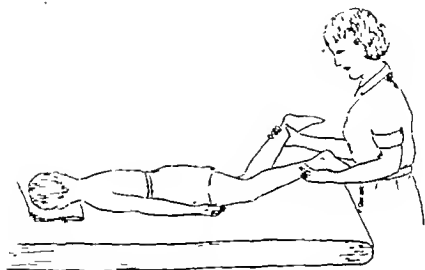


Fig. 22—"Yankee Doodle," with patient prone.

Advanced Arm Exercise

I. Grind the Coffee

supine Internal and external rotation—shoulders
Flexion and extension — elbows

This exercise is given singly, one arm at a time. Flex the elbow until the open palm touches the shoulder. Bring the hand in toward the chest, then toward the stomach and downward until the elbow is fully extended with the back of the hand resting on the bed. Continue the motion by bringing the hand out away from the body and finally upward to the shoulder. The hand directs the elbow in a circular motion without stopping at any one point. The open palm faces the shoulder upon starting and should maintain this position for the entire exercise. Elbow should remain firmly placed in one position on the table throughout the entire exercise.



Grind the cof-fee; Grind the cof-fee; Grind, grind, grind.
(Repeat)

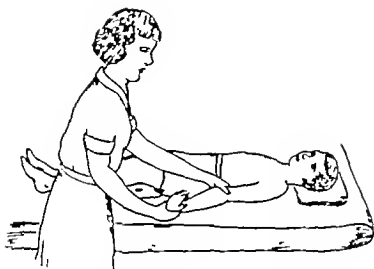


Fig. 23—"Grind the Coffee," with patient supine.

Advanced Leg Exercises

1. Shoot the Rocket supine Flexion—hip

Raise the assisting leg from six to ten inches upward toward the ceiling, keeping the knee straight and with the leg in good alignment to the body. Begin the exercise by raising the leading leg in the same manner while the already raised leg is lowered down on bed until it assumes original position. Both legs move at the same time but in opposite directions.

prone Extension—hip

Raise the assisting leg from four to six inches upward toward the ceiling with the knees held straight and with the leg in good alignment to the body. Begin the exercise by raising the leading leg in the same manner while the already raised leg is lowered down on bed until it assumes original position. Both legs move at the same time but in opposite directions.



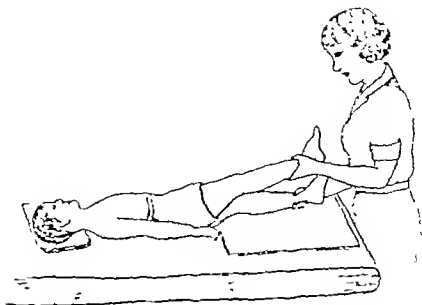


Fig. 24—"Shoot the Rocket," with patient supine.

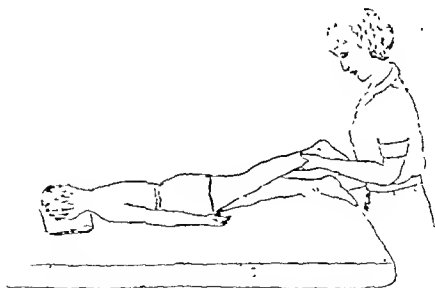


Fig. 25—"Shoot the Rocket," with patient prone.

2. Roll Over and Over

supine Internal and external rotation — legs

Begin the exercise by rolling both legs in for internal rotation and then out for external rotation. Both legs should be put through the same range of motion, rolling in and out at the same time.



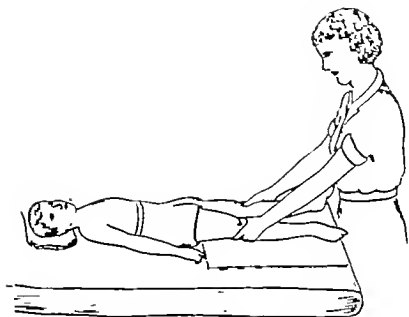
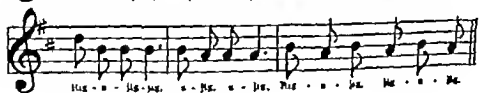
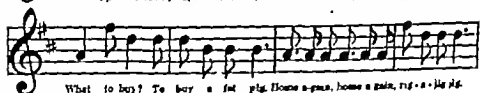


Fig. 26—"Roll Over and Over," with patient supine.

3. Up and Down

supine Dorsal and plantar flexion—
sitting ankle

Flex the assisting ankle up toward the anterior part of the leg. Begin the exercise by flexing the leading ankle upward in the same manner while the already raised ankle is lowered to a plantar flexed position until the toes face down toward the floor. Both ankles move at the same time but in opposite directions. The toes should remain motionless during the entire exercise.



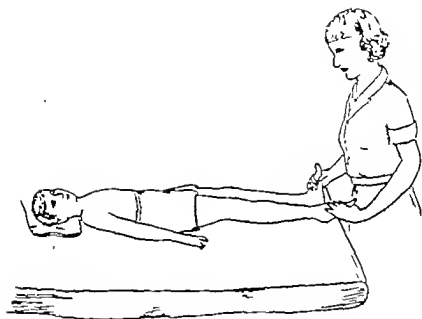


Fig. 27—"Up and Down," with patient supine.

4. This Way, That Way
(weather vane)

supine
sitting

Inversion and eversion—foot

This exercise is usually given singly, one foot at a time. Begin the exercise by turning the foot inward so that the toes face in the direction of the other foot. This is for inversion. Then turn the foot in the opposite direction, toes facing outward, for eversion. Should the particular patient walk with the foot held in eversion or inversion, stress the direction needed and eliminate the other.



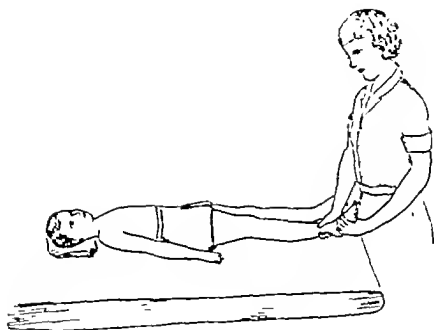
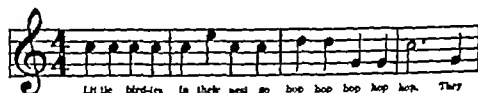


Fig. 28.—“This Way, That Way,” with patient supine.

5. Little Birdies

supine Flexion and extension—toes
sitting

Flex the toes on the assisting side of the body. Begin the exercise by flexing the leading toes while the already flexed toes are extending. The toes should move at the same time but in opposite directions. Ankles should remain in a neutral position during the entire exercise.



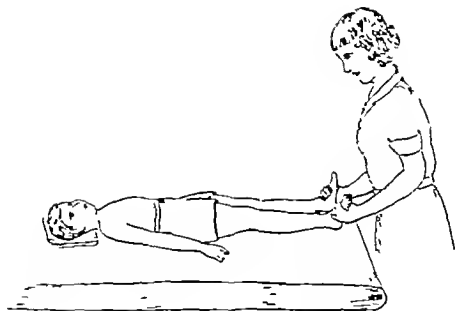


Fig. 29—"Little Birdies," with patient supine.

Walking Exercise

1. Bobby Shafto

walking High knee bend and foot
step placement

Bend the assisting knee so that the foot is from six to ten inches from the floor. Begin Bobby Shafto walking by lifting the leading leg in the same manner while the already raised leg is lowered to floor. A step should occur when the foot touches the floor. Rhythm and timing should be stressed.



Summary

All types of cerebral palsy are given conditioning exercises. The only distinction is the period of training at which the conditioning is given.

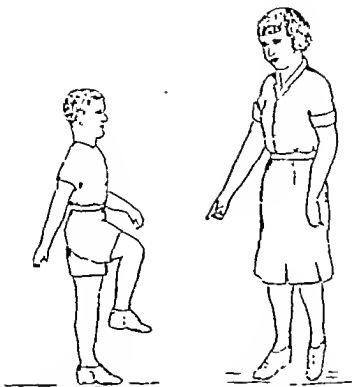


Fig. 30—"Bobbie Shafto," walking step.

CHAPTER XIV

AUTOMATIC OR CONFUSED MOTION

There are three groups of spastics; those that have stretch reflexes only, those that have O.C. muscles only, and those that have both. This chapter will discuss the two groups that have O.C. muscle involvement, since automatic or confused motion is used only for treatment of O.C. muscles.

An O.C. (zero cerebral) muscle is a type of muscle disorder found in the spastic group which can be made to work only if given confused motion. As has been stated before, an O.C. muscle is not spastic, having no stretch reflex. Its distinguishing characteristic is that it has no voluntary ability to contract at will. It is similar to the 0 (zero) muscle found in the poliomyelitis case and is tested in the same manner. Dr. Phelps identifies it as being O.C. which clarifies the term used for a condition originating in the brain.

When testing for O.C. muscles the trainer should first observe whether the muscle can contract with gravity eliminated. For further testing, the muscle should be put in its contracted position to see whether the child can hold it. If he is unable to hold the contracted position the muscle can be recorded as O.C. The test should be given to all muscles found not to be spastic.

In order to make an O.C. muscle function an impulse must be given to the part affected. This is accomplished by finding somewhere else in the body a muscle or muscle group which, when resisted, will carry the impulse to the desired O.C. muscle. The force of effort that the child makes against the resistance causes many impulses to come through and one resisted action, found anywhere in the body, will bring the impulse to the desired O.C. muscle and it will contract.

Dr. Phelps discovered confused motion while observing a child at play. The child was a spastic who walked with a dropped foot due to the fact that he had no voluntary ability to contract the dorsiflexors of the ankle. Upon examination, no stretch reflexes were felt in these muscles, showing them to be O.C. muscles and not spastic. One day while Dr. Phelps was watching him the child picked up a heavy box from the floor to put it on a table. In trying to carry out the act he placed the box on his knee and lifted it by using the hip and knee flexors and the foot came up into dorsiflexion. The weight of the heavy box was the resisting factor to the hip and knee flexors and the resistance of that group of muscles produced the impulse that caused the dorsiflexors to contract, thereby bringing the foot up into dorsiflexion. Dr. Phelps then placed the child in a sitting position on the edge of the table with his legs hanging over the side and produced the same action in the ankle by giving manual resistance to the hip and knee flexors.

When an O.C. muscle is found the trainer should go through the entire body giving resistance to all the motions in order to find the particular resisted action that will bring about the desired contraction. This resisted action which produces the contraction of the O.C. muscle is a confusion, and it is this confused motion which is trained to do the work for the O.C. muscle. Regardless of the amount of power the O.C. muscle gains, it never contracts actively, but is always dependent upon the confused motion for its action.

The same confusions do not work on all individuals, but, since there is always a confusion somewhere that will produce the needed impulse, the trainer must find it for successful treatment.

Confused motion is based on the principle of pathological overflow. It is entirely different from athetosis, stretch reflex, or normal overflow, and should not be mistaken for any of these conditions.

For training purposes a maximum amount of resistance is applied at first to the confused motion and should be gradually lessened as the stimulated O.C. muscle gains power. When the trainer decides to progress, the confused motion can be given against gravity which is used as the resisting force and will produce the desired action of the O.C. muscle.

At this point constrained motion can be substituted. One muscle working against its contracted antagonist in the confusion provides the resistance needed to contract the O.C. muscle. Training is continued with constrained motion until the patient is capable of executing the action of the O.C. muscles by just thinking of the confusion. No matter how well trained the O.C. muscle may appear to be, the child must always think of the confusion first in order to execute the action.

The trainer must observe closely that stretch reflexes and overflow do not occur to other muscles in the body while giving confused motion.

The following cases are given in order that the reader will have a better understanding of the treatment for confused motion.

Case 1.—A girl, aged ten, with mild spastic paraplegia, having both legs involved. Walking executed with knee flexed, hips internally rotated. Standing balance maintained by pressure of knees held together. Typical scissors gait walking picture. Upon examination gluteus medius of both hips recorded as O.C. Confusion found was resistance to deltoid muscles of the shoulders.

Treatment: The legs were placed on a polished board to assure a frictionless motion, with the child in a supine position. Resistance was applied to arm abduction. At start of training the confusion failed to work with two or three tries, as is usually the case. Gradually, however, more and more exercising was administered bringing about a wider range of motion to the legs. After several months of training, this girl progressed to constrained motion and no longer required assist-

ance of the trainer. Advancing to a standing position, a wide bandage was applied, holding the arms close to the sides of the body. Bandage acted as the resisting factor which produced leg abduction while walking. Bandage was gradually loosened and finally removed permanently.

Result: Satisfactory. Walking was executed with more ease and with improved appearance.

Even though this patient seemingly learned to move the O.C. muscles voluntarily, the confusion was thought of every time she wished to make the motion.

Case 2.—A boy, spastic hemiplegia. O.C. muscles recorded in supinators of forearm, wrist extensors, finger extensors. Confusions found in uninjured arm when corresponding motions were resisted.

Treatment: With child in supine position resistance was applied until constrained motion was substituted in training. Child progressed to a sitting position where he was better able to observe motions being executed. After learning fundamentals of confused motion, the boy was referred to Occupational Therapy Department.

Result: O.C. muscles were developed to the point where injured hand could assist lead hand.

Case 3.—Spastic quadriplegia. O.C. muscles recorded in wrist extensors, finger extensors of one arm. Confusion found was resistance to elbow flexor with forearm held in pronation, same arm having the O.C. muscles.

Treatment: Child in supine position progressing to a sitting position. Resistance applied to elbow flexor until child progressed to constrained motion. Long training period necessary since spasticity involved all four extremities and stretch reflexes and overflow had to be eliminated. Child referred to Occupational Therapy when training was far enough advanced.

Result: Good use of hand in learning useful activities.

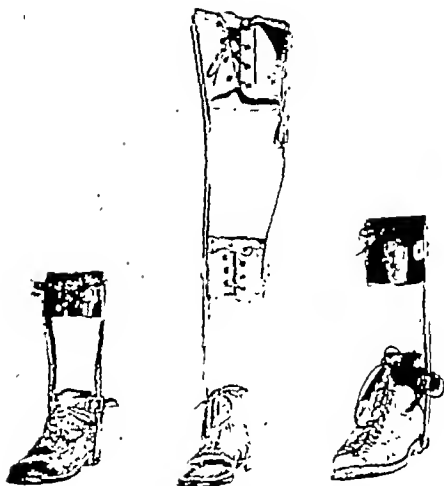


Fig. 31—(a) Short ankle day brace with right angle stop at ankle. (b) Long leg stiff night brace. Purpose of this brace is to hold gastrocnemius in a stretched position. Bar at ankle joint can be cocked up from time to time to maintain a greater stretched position. (c) Outside single bar stiff ankle brace is worn nights. The brace is worn to hold the gastrocnemius-soleus in a stretched position. The angle of the bar at the ankle is changed from time to time as the heel cord stretches.

In addition to training O.C. muscles to work by means of confused motion, massage must be administered to them whenever treated. The part being massaged must be relaxed and, to assure this, must be protected against stretching.

It is a good idea to keep the O.C. muscle in a rested position when it is not being exercised. This can be accomplished by using a splint or brace to be worn during the day or at night, depending on the individual case. For instance, when the dorsiflexors of the foot are O.C., a brace worn at night will keep the foot from being pulled into plantar flexion, which latter puts a stretch on the O.C. muscles. In the case of a child whose wrist and finger extensors are O.C., a cock-up splint worn during the day will maintain a corrected position and keep the O.C. muscles from being stretched.

Any appliance of this nature must be ordered by the doctor in charge of the case. However, the trainer, when finding an O.C. muscle, may be able to recommend an appliance suitable for the individual.

Summary

Spastic: Specialized technique for educating O.C. (zero cerebral) muscles found only in the spastic group.

Athetoid: Not found in athetoid.

Tremor: Not found in tremor.

Ataxic: Not found in ataxic.

Rigidity: Not found in rigidity.



Fig. 32—A standing table for four children is accomplished by varying stool heights.

bined motion is extremely important because it is at this stage in the training that eye-to-hand coordination can be taught and a strong tactile sense developed, the latter acting then as the child's stabilizer.

Summary

It teaches the combination of two active simple joint motions that are to become useful to fulfilling everyday needs.

Spastic: Very advanced stage of treatment. Speed and accuracy are stressed.

Athetoid: Same as spastic.

Tremor: Same as spastic.

Ataxic: Reached more readily by ataxic child. Eye-to-hand coordination stressed.

Rigidity: Same as spastic.

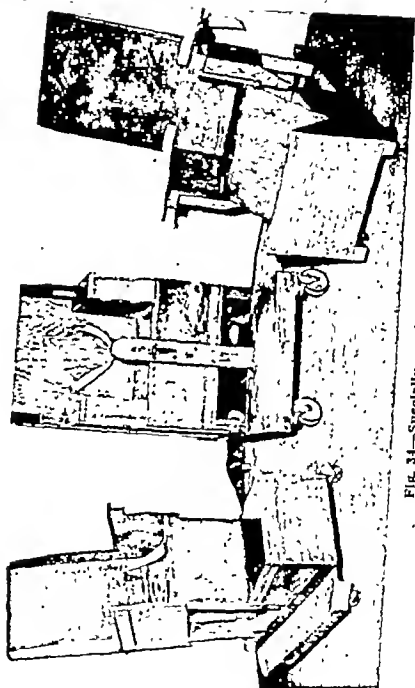


Fig. 34—Specially constructed chairs.

Chairs and tables should be constructed with correct foot and arm rest in order to assure the maximum amount of rest. Tables should be wide enough to support the arms while the child is doing hand activities. A child who finds it difficult to sit erect, due to back or abdominal weakness, will expend a great amount of energy to maintain the position and, as a result, may become cross and nervous. The latter interferes with any activity or treatment. For this child a corset or back support will hold the desired position and give the part of the body its needed rest.

Therefore, each individual cerebral palsy child must be studied in regard to rest, making certain that he gets total and individual rest in the right quantities.

Summary

Braces, individually constructed chairs and tables, and diet are essential for maintaining the maximum amount of body rest for all types of cerebral palsy in the course of the day.

CHAPTER XVII

RELAXATION

Relaxation is a specialized technique and is described by Edmund Jacobson in his book, "Progressive Relaxation." It was written for the purpose of decreasing tenseness found in normal adults but not in the handicapped. However, with some exceptions and with parts of the treatment modified, this relaxation training is used for the cerebral palsy patient.

Relaxation is started proximally, progressing distally, since it is useless for the handicapped child to have a perfectly relaxed hand if the uncontrolled shoulder constantly moves the arm away from the body.

Relaxation training requires a considerable amount of patience and time since it includes all the muscles in the body. Each muscle is apt to have a varying degree of muscle tone which becomes lowered when relaxation is applied. Relaxation should produce a looseness in the muscle and a sensation of freedom from tension or tightness in the child.

In order to teach the sensation of relaxation the trainer should begin with a muscle that can be easily seen and felt by the child and, through application of motion, utilize this muscle for demonstrating what is meant by tightness or looseness. The trainer should have the patient tighten the muscle against resistance and, when released suddenly, the patient should then feel looseness or relaxation.

After the difference of sensations has been clarified in the child's mind and he understands that looseness is desired, the picture is broadened by using the entire arm.

The ultimate aim in relaxation training is: one, to teach patient to relax all over, completely and instantly;

two, that the patient should be able to maintain relaxation for long periods without the presence of tension to any of the muscles in the body.

Theoretically, the training is started with the forehead, eyes, mouth, then a combination of all three, and on down through the parts of the body proceeding always from proximal to distal in the extremities. However, with the handicapped child, the treatment is started in the least involved parts. This will be explained more fully later in the chapter. Whenever involvement permits, the training should begin with the forehead.

In order to learn the fundamentals of relaxation, each part being trained must first contract and, after holding the part in a contracted position for a certain number of counts (usually 5), it should be released suddenly, bringing about relaxation. This state should be maintained for 10 counts. The importance of looseness must be stressed and the child must be conscious of the feeling. The count may vary if the child puts too much emphasis on the contracting period.

When the trainer tells the patient to relax the part, it does not mean that it is to return to midline but to "let go." For instance, when the mouth is relaxed it is open slightly, teeth are partially separated, and the tongue lolls around.

The expression "let go" can sometimes be used to better advantage than the term "relax."

Relaxation training should be started in a lying position with the child as comfortable as possible. Pillows, large and small, may be used to assure the maximum amount of comfort. In a great many cases the position that the child assumes when falling asleep is best used as a starting position. Sandbags are a definite aid to the training if used for the purpose of holding down other parts of the body not being trained at the moment. The child will have less to think about and will be better able to concentrate on arm relaxation, for instance, if the legs are held down in a comfortable position.

Relaxation should be stressed only to the part being worked upon and not to other parts of the body. Also, it should be assured that the part can relax in all the lying positions before progressing to the next joint. Progression should not occur until all preceding parts can be relaxed satisfactorily for the trainer. After a child has learned the fundamentals of relaxation in a specific part, it is a good plan to go back to the beginning and go through the already trained parts before progressing. In this way, relaxation is repeated constantly; this is the proper method of teaching.

When all individual muscles can be relaxed in an extremity, the trainer should progress by combining the parts.

- (1) both arms
shoulders
elbows
wrists
fingers
all flexor motions
all extensor motions
- (2) both legs
hips
knees
ankles
toes
all flexor motions
all extensor motions
- (3) arms and legs
flexor motions (fetal position)
extensor motions

When relaxation can be accomplished by contracting and letting go, the child should be taught to tighten the desired parts without making a motion. Then the speed for contracting should be increased until finally relaxation can be felt instantly on command. Sitting and standing relaxation training follows all lying positions.

It will take about one year or more, depending upon the mentality of the child and the extent of involvement, to teach complete and instantaneous relaxation.

Training in relaxation should always be taught physically rather than psychologically. It must be a conscious learning on the part of the child. Drawing mental pictures by saying such things as "make yourself as soft as a kitten" is confusing and of no use when relaxation is most wanted. Mental suggestions should be avoided. The direct method should be applied since a conscious control is necessary. The use of artificial methods, such as warm baths, soothing music, sedative massage, and treatment given in a soundproof room is an indirect method of teaching and is of no use because the child will grow dependent on them and will not relax without them. It is a waste of time because eventually the child must begin to learn relaxation directly in order that it will be of use to him.

The cerebral palsy patient should be treated in a room with a certain amount of normal confusion going on, such as the sound of other voices, an occasional ring of a telephone, opening and closing of a door, and, on occasion, the presence of visitors. This kind of confusion is usually present wherever the patient may be, and it is important that relaxation be maintained under any existing conditions, exciting or otherwise. This way confusion is continuous for the patient instead of starting after a period of quiet during treatment.

It is extremely difficult for the child to maintain relaxation when commended immediately for relaxing a given part. It is a good plan for the trainer to commend only after a part has remained relaxed for a few minutes. In fact, commendation can be used over the body as a means of testing relaxation. If the child can maintain relaxation in a part while the trainer refers to it, a good conscious learning of relaxation has been accomplished.

Relaxation Outline

Forehead

elevate the eyebrowslet go
lower and scowllet go

Eyes

open wide (include forehead)let go
squeeze eyes and scowllet go

Eyeballs

look uplet go
look downlet go
look leftlet go
look rightlet go
look off into spacelet go
look directly in frontlet go

Mouth

grin (showing teeth)let go
purse mouth (mouth small and round)let go
open jawslet go
close jaws (grit teeth, push lips together)let go

Tongue

extend (out of mouth)let go
retractlet go
rightlet go
leftlet go
elevatelet go
depresslet go

Pharynx

push back of tongue up (say ugh, ung)let go
breathe through nose three times
breathe through mouth three times
breathe through mouth and nose together

Larynx

breathe evenly through mouth and nose three times
count by whispering
count out loud

Neck

raise head off pillow	drop
push head down on pillows	let go
turn head right	let go
turn head left	let go
tip head to left	let go
tip head to right	let go

Scapula

hug shoulders	let go
push shoulders down	let go

Ribs

expand chest (deep breathing)	let go
depress chest	let go

Abdominals

stick out stomach (suck air in)	let go
pull stomach in (blow air out)	let go

Ribs and abdominals

breathe in deeply (both together)	let go
breathe out deeply	let go

Shoulder

lift off bed	drop
push down on bed	let go
push out	let go
push in	let go
roll in	let go
roll out	let go

Elbow

bend	let go
straighten firmly	let go

Forearm

roll in (keep elbow slightly flexed)	let go
roll out	let go

Wrist

flex	let go
extend	let go
ulna devlation	let go
radial deviation	let go

Fingers

open wide	let go
close (make fist)	let go
oppositon (thumb to fingers)	let go

Hip

lift off bed	drop
push down on bed	let go
push out	let go
push in	let go
roll out	let go
roll in	let go

Ankle

dorsiflex	let go
plantar flex	let go
invert	let go
evert	let go

Toes

curl under	let go
straighten	let go
close together	let go
spread apart	let go

Athetoid

Relaxation is the most important phase of training for the athetoid and is a basis for all other forms of treatment. The aim of treatment for the athetoid is to eliminate or diminish the athetosis to a small enough degree that voluntary movements are made possible without interference from the involuntary motions.

Athetosis disappears completely with sleep and is greatly lessened when the child is overtired or sleepy.

Relaxation can be thoroughly learned, thereby reducing the amplitude of athetoid motions to an almost negligible degree. The patient will then turn to relaxation for control rather than to tension and, as a result, improvement will continue constantly.

The athetoid motions and reaction for seeking control are similar to a normal person's attempt to write on a piece of paper while riding on a rough road in an automobile. In order to accomplish it the person automatically tenses his arm and leg. This tension will produce very bad writing since all the jolts from the automobile are more forcefully transmitted to the hand. If relaxation could be assumed for the act of writing, the joints would act as shock absorbers and the writing would be greatly improved.

In order to treat athetosis successfully the trainer must be properly trained in the teaching methods of relaxation since this modality is basic and utmost in importance to the athetoid child. The primary ability to move is undisturbed in the athetoid because the damage does not involve the voluntary motor system. These activities become hampered, however, due to the involuntary motions which steer the attempted voluntary motions in the wrong directions. It is, therefore, a waste of time to teach an athetoid reciprocal leg exercises before relaxation since the action is blocked by the athetosis and can be executed only when the athetosis becomes diminished with relaxation. For this reason it can be seen that repetitive training will be of little or no value until relaxation is learned completely. And, unless this relaxation includes all the parts of the body, athetosis will not subside. For example, tension in a hand will allow athetosis to continue in another part of the body, and not until the child is completely free from tension will he be able to remain perfectly quiet.

The use of mirrors during relaxation training is extremely helpful and they should be placed so that the child can observe himself while being treated in all positions. They should be placed on the ceiling over



Fig. 35—Relaxation to the entire body with emphasis to the left shoulder. Pillows under right shoulder is a reminder and aids patient in learning the feeling of control of atelosis to this part. The metronome here acts as a clock in order that relaxation can be timed and graphed.



Fig. 36—Teaching relaxation in a side-lying position. The pillows are placed between the upper arm, under the head, and the body is flexed. Here the control of athetosis is aided by the use of sandbags.

his head for exercises in a supine position, placed before him while exercising in a chair or while walking. The athetoid is not always aware of the involuntary motions taking place and, therefore, cannot control them properly until he observes the motion.

For the nontension athetoid the relaxation training begins with the part of the body showing the least amount of athetosis and, when learned, progresses to the more athetoid extremities, always starting with the proximal joints. It includes all the muscles of the body and it continues until the patient is able to relax completely when thinking about it, regardless of existing conditions.

While teaching relaxation, avoid setting a goal so far as actual accomplishment in a given period is concerned. If a goal is set and not reached many frustrations and complications appear which hinder the training.

Relaxation training is extremely difficult for the athetoid since it requires a considerable amount of effort to stop the athetosis. It is, therefore, a good plan to give a rest period at which time the child should be free to move as much as he likes. These rest periods should not be given too frequently, and, when allowed, should be timed by the clock. The athetoid will try to get out of doing his work, if possible, and will find excuses to delay his training. Because of this, the trainer should set the length of time to be spent on a specific part, making the set period known to the child, and should adhere to it without any interference.

It is also wise to work specifically on one part of the body for a certain length of time and then, regardless of whether or not it is accomplished, continue with the treatment by placing the child in a different position. This will stimulate the patient and make treatment less tedious.

The trainer must become clock conscious and place the emphasis on the length of time spent rather than the actual accomplishment. Talking in most cases



Fig. 37—Teaching relaxation in the supine position is usually the most difficult and therefore follows all other lying positions. A greater need for sandbags is indicated.



Fig. 38—Standing in the "standee" teaches patient the sensation of a standing-up position with emphasis on relaxation. The holes in the board allow the shoulder brackets to be moved making this piece of equipment adjustable for any size child.

increases the athetosis and should not be allowed during working time, only during the rest periods.

As has been stated before, at least a year is needed before the child can accomplish complete and instantaneous relaxation. The trainer should not expect too much at first. The athetoid has never been able to remain quiet during his waking time and must be shown patiently, muscle by muscle, how to do it.

When starting relaxation training in the extremities the child should be placed in a comfortable position, preferably one to his liking. If working on an arm, only shoulder control should be stressed. After a certain length of time the patient should be turned either to prone or supine position and treatment continued in the same manner, still stressing shoulder control. When the child is ready to progress, the shoulder and elbow should be combined and exercised in all lying positions. The progression should be made, in the same manner, down to wrist and fingers. Each arm is exercised in this manner and then both arms are combined until they can relax instantly and can maintain relaxation for a desired length of time. This same routine is followed with the legs until finally all four extremities can be relaxed together.

When relaxation can be maintained in all lying positions, the progression is made to a chair-sitting position and finally to a standing position.

Of course this progression takes place over a long-term period. A beginning single treatment period could include relaxation treatment for one joint only and an advanced treatment period could include conscious relaxation of the whole body. The rate of progression is decided by the trainer on the basis of the child's intelligence and amount of involvement.

With the very young athetoid child it is sometimes necessary to teach relaxation by using the simple joint conditioning exercises and their corresponding rhymes.

The motions are executed more or less without the patient's attention and will accomplish the desired result of relief from tension. It is almost impossible to teach a child below the two or three-year age level a conscious relaxation. Therefore, the conditioning method is substituted.

At the beginning of the relaxation training, the individual timing graphs should be implemented once a week, preferably on the same day each week. This has proved an accurate form of record whereby actual improvement can be watched closely.

The patient becomes aware of the timing which serves as a form of treatment in itself since it follows the routine of training and teaches the child something about his treatment.

The trainer, when preparing a graph, should describe the child's position and the use of appliances, if any, so that each time an addition is made to the graph the child will begin his treatment in the original position and go through it in exactly the same manner. The metronome, if set to correspond to a clock, is used for timing purposes because the trainer can then listen to the click of the metronome while watching the part being timed.

By using a graph anyone interested in the child will be able to see at a glance whether or not the child is responding to this particular form of training. In some cases the graph acts as an incentive to the child; he will put forth a greater amount of effort to have a better showing. Graphs, therefore, are beneficial both to trainer and child.

Appliances such as braces, splints, extension cuffs and sandbags may be applied for relaxation training. They should be used sparingly, however, so that the child does not become dependent upon aids. They are used chiefly for the purpose of quieting parts of the body not being exercised at the time of treatment. For instance,

braces may hold the legs in a corrected position and free from motion while the arms are being trained in relaxation. An extension cuff applied around the elbow may hold it motionless while stressing relaxation training to the shoulder. A sandbag may hold the leg on the table while relaxation exercises are given to the hip. Appliances such as these are helpful but, when used, should be removed for a time during each treatment period in order that relaxation may be tried without their help. Then, if there is a carryover, it will be revealed when the appliance is removed.

The reason that so much emphasis is put on relaxation training for the athetoid is that it gives him a basis for all purposeful motions.

Tension Athetoid

A tension athetoid is one who has formed a habit of tensing voluntarily in the hope of stopping athetosis and the resulting involuntary motions. It has no connection with excitement but is solely a voluntary attempt to stop excess involuntary motions. The fact that tension may be found while the child is asleep proves that the condition is not pathological; it is pure habit. It is believed that the athetoid who tries to stop the involuntary motions has a higher degree of mentality.

Because this habit of tensing may start as early as seven months it is best for this type of child to receive training as early as possible. When tension becomes habitual no voluntary motions can be executed without causing extreme stiffness in the joints. Each voluntary motion attempted becomes blocked, making motion almost impossible.

In some cases, the tension athetoid resembles the spastic in appearance and is often mistaken for one. The differentiation can be determined by shaking the part of the body which is tense. If the tension is the athetoid type the part will become relaxed momentarily because the tension in this type is caused by a voluntary

attempt at control; if the tension is spastic in type the lenseness will increase and become fixed because the tension in a spastic is caused by outside stimulus.

The training for the elimination of tension in an athetoid is entirely separate from the training for the elimination of athetosis; tension must be ruled out before starting progressive relaxation. Start by training in a voluntary release of tension to all parts of the body and forget about the athetosis for the time being. The child must experience the sensation of stability in the extremities. It can best be accomplished by using sandbags of varying weights all over the body. These weights are applied for the purpose of holding down the arms and legs on the table in a correct position. In time, tension will release and, when the sandbags are removed, the sensation of release will remain and a conscious voluntary release of tension will result.

The position the extremity assumes depends upon the amount of tension found in the individual muscle. For example, if there is a maximum degree of tension in the biceps muscle, the elbow will be held in a contracted flexed position. It may be so overpowered from tension that a considerable amount of effort from the trainer will be needed to extend the elbow passively. When this condition is found, it is a good plan to treat the part by holding the elbow in as much extension as possible and waiting for voluntary release. Upon feeling the slightest degree of release, the trainer should lower the hand toward the bed by extending the elbow as much as possible. In this way the child can learn a conscious voluntary release. When release of tension is complete and the elbow can be fully extended, a sandbag should be placed so that extension will be maintained with the arm held in a corrected position on the bed. Eventually, release is speeded up until it can be accomplished on command. However, if this method is tried and no release can be detected, another method is used. The trainer extends the elbow passively and, when fully extended, places a heavy enough sandbag over the part to hold

it in a corrected position. When the part can finally remain extended after the removal of the sandbag, the trainer should flex the elbow and emphasize voluntary release so that active extension can be executed. It depends upon the individual and the amount of tension found which method the trainer will use for starting the training.

The tension athetoid must go through this additional beginning step, the elimination of tension, before progressing to the next stage, progressive relaxation. During the progressive relaxation training his treatment is the same as for the nontension athetoid.

Spastic

The training for a spastic differs from that of the athetoid. The spastic learns a conditioning for relief from tension rather than a training in relaxation. A stretch reflex contraction will be more violent if tension is present in that particular muscle so the spastic must be taught, by means of conditioning, to eliminate tension in that muscle and all like muscles, in addition to eliminating tension in normal muscles. He becomes tense with fear with the occurrence of outside stimuli such as the presence of strangers, loud noises (a hand clap or the slamming of a door), sudden jars, et cetera. The importance of training for the spastic is to teach him how to maintain relaxation in spite of these outside stimuli.

In order to teach the spastic, a disturbing stimulus is deliberately initiated and he is taught to relax in spite of it. For instance, if a hand clap is disturbing, the child is placed in a supine position and, with the hands of the trainer clearly visible, he is told when a hand clap is to be made. When this is no longer disturbing the trainer claps unexpectedly. When this can be done without the presence of tension the trainer progresses by clapping with the hands out of sight. Each new step will be disturbing when first presented. In a short time, however, the spastic loses his fear for the particular act

and will be able to maintain relaxation whenever hearing a hand clap. As long as fear is present in a spastic, relaxation cannot occur. By producing artificially the same stimuli to which a spastic reacts fearfully, the trainer shows him, by gentle steps, that he will not be hurt in any way. The result is relaxation from tension.

In a great many instances the spastic child is even extremely fearful of starting treatment because of the newness of environment and strangeness of people around him. For this reason it is a good idea that he be permitted, for the first two of three visits, to become acquainted without actually receiving treatment. If he is allowed to observe other treatments casually he will become better adapted to his own. It is also best to explain each new phase of training to him before starting so that he will not be startled.

Placing the spastic in a lying position on the treatment table is apt to be disturbing and should be introduced with care. The use of sandbags along the body and, if necessary, over the body, will provide more security.

Every step should be almost imperceptible. For example, when teaching the spastic to stand, by having him lean against the wall, he should be placed in the desired position, gently, and the trainer should hold on to him until he understands that he is to remain standing without assistance. Giving him security until he has a chance to get used to new things eliminates fear and he will make more of an effort to accomplish the act.

The spastic must, therefore, be conditioned to outside stimuli in order that he may maintain relaxation. The aim is not to shield the child from disturbances but to teach him to relax in spite of them. This form of training is not given as a basis for treatment, as with the athetoid, but is stressed throughout the entire training whenever needed.

Ataxic

The ataxic children show no evidence of tension or involuntary motions anywhere in the body; therefore, there is no advantage in giving relaxation training to them.

Summary

- Spastic:* Conditioning to outside disturbances upsetting to the spastic. Stressed throughout treatment.
- Athetoid:* Primary importance and is beginning treatment. Basic for training purposeful motions.
- Tremor:* Same as athetoid.
- Ataxic:* No need for learning relaxation.
- Rigidity:* Same as spastic.

CHAPTER XVIII

MOTION FROM THE RELAXED POSITION

Motion from the relaxed position is a modality which follows the learning of relaxation and is used chiefly for training the athetoid group. It should be introduced in treatment only if the athetoid can maintain relaxation to all parts of the body for a given length of time.

Motion from the relaxed position is given for the purpose of teaching the athetoid how to move the arms and legs, maintaining complete relaxation while doing so. This is an extremely difficult task and, in a great many instances, this modality, when started, has to be discontinued with emphasis placed again on relaxation. For the best results from treatment, the training should be thorough, taking as much time as needed.

Muscle training or muscle re-education is not of primary importance to the athetoid, due to the fact that, underlying the athetosis, the fundamental ability to move is undisturbed. Therefore, a reciprocal action of a joint may be performed with ease and without distortion when free from involuntary motions.

Keeping this in mind, motion from the relaxed position is simply a method of moving passively different parts of the body while the patient maintains relaxation. It should be administered in all positions with the patient as comfortable as possible.

Supposing an athetoid child, while in a side-lying position with a pillow under the head, between the legs, or anywhere else necessary to secure a comfortable

position, can remain quiet for about five minutes. The trainer should direct passively a simple motion, such as elbow flexion and extension. While moving this part the trainer should observe closely all other parts of the body for control of overflow. If relaxation can be maintained the position of the patient should be changed, the pillows rearranged, and the same simple motion repeated in this changed position. When this motion can be executed successfully in all positions without disturbing the relaxation, another simple motion should be chosen and directed in the same manner. Then the progression to more complicated parts should be made until all simple motions in the body can be passively directed in all positions, with relaxation maintained.

Gradually the use of pillows may be decreased and the side-lying position eliminated, so that the child will eventually lie in a prone or supine position with the body in a straight line.

It is a good plan to start motion from the relaxed position, with the child sitting in a "relaxation chair," (see Apparatus and Equipment) soon after starting this phase of training in a lying position. Sitting in a chair becomes just another position for the child to work in and is an important one for all arm activities.

For this modality, aids such as splints, extension cuffs, and sandbags may be used. Braces, if prescribed for the individual, may also be worn. However, any aids used should be removed at least once during each treatment period so that the child will not grow dependent upon them.

Once relaxation has been mastered, all other phases of training for the athetoid are simply follow-up measures of training. Motion from the relaxed position is important in that it shows whether the child has learned and can maintain conscious control under all conditions.

Summary

Spastic: Not given to the spastic.

Athetoid: Very important modality for the athetoid.
When athetoid concludes relaxation treatment he must learn to maintain it while having the arms and legs moved passively by trainer and so is given Motion From the Relaxed Position.

Tremor: Same as athetoid.

Ataxic: Not given to the ataxic.

Rigidity: Not given to the rigidity.

CHAPTER XIX

BALANCE

In order to maintain balance, muscle groups and their opponents must work with proper accord in relation to each other. The proper amount of tenseness should be placed on the needed set of muscles to maintain correct balance, regardless of the position assumed by the individual. The art of balancing is required for the purpose of maintaining such specific positions as sitting, kneeling, crawling, standing, and walking. The pull of gravity which occurs with each bodily movement changes the relationship of the muscle to its antagonist. During these changes muscles contract, thereby increasing the tone to its proper amount, and, at the same time, the antagonist group relaxes at the proper speed. This makes body motion possible with balance maintained. Any factor which upsets this muscular activity will disturb the balance. Because of this, the cerebral palsy victim is unable to balance voluntarily and must, therefore, be taught.

Dr. Phelps has outlined a specific method for teaching balance which differs with each of the three types of cerebral palsy. For the most part, it is a difficult phase of training. Patience and time are paramount.

Before starting this modality, the trainer should prepare the child by explaining the treatment. While fear is not as highly developed with the athetoid and ataxic as with the spastic, all of the children have a fear of falling. Conversation should not include the word "afraid" or any other synonymous word or phrase which might put greater fear into the individual's mind. Progression from one step of the treatment to another should be gradual and commensurate with the child's physical ability.

Like any other form of physical training there is a starting point which must be kept in mind. Certain fundamentals must be learned before the desired results can be mastered. For instance, the child who cannot maintain correct head position because he has no control over the neck muscles, will not be able to stand alone. Therefore, emphasis should be placed on head control before progressing to the next stage of training. Head control may be taught in all positions, with the rest of the body strapped down. The child can then place his entire attention and effort on the specific part of the body being trained.

When the head shows the proper amount of control the body should be freed farther and farther down, until the child is able to obtain a sense of balance in a sitting position. Sitting should be taught first with the child in a supported position, progressing then to an unsupported position. Then the head should be combined with the trunk by placing an "Alexander Ball" (see Apparatus and Equipment) in the center of the child's head and continuing the treatment until he can control it. This requires a fine sense of balance.

Crawling should be started as soon as the upper part of the body shows an adequate amount of control. This activity may require manual help from the trainer when first starting. Crawling is a definite aid to walking since it teaches the child reciprocation of both the arms and legs. For the very young child, crawling may be induced more readily if a toy is placed a short distance away from the starting point. In some cases the height of the treatment table slows up the progression, in which case the floor is best used.

In order to maintain balance in a standing position, balance must first be accomplished on the knees. Therefore, after crawling can be performed satisfactorily, progression should be made to a kneeling balance. This phase may first be given with assistance from the trainer or by having the child hold on to a stationary pole, the



Fig. 39—Sitting before the mirror head control and balance are taught by placing the "Alexander Ball" in center of head.

choice of technique depending upon the individual's hand control. As the training progresses and the child no longer needs outside assistance, balance should be trained with the arms free to move in air. The latter will aid in maintaining the balance. Sometimes weights in hands are aids for balance training. Again, it depends upon the hand control. Nothing should be introduced which will divert the child's attention because the emphasis must be on balance.

When kneeling balance is satisfactory, progression should be made to standing balance. This phase of training is started by placing child in a standing position against a wall. The trainer may sit on a low stool, preferably one on wheels, about one foot away from the child. As the child acquires a sense of balance, the trainer may move away gradually until the child is able to maintain the standing balance without having anyone near. Then he should be taught to pull forward until he is able to stand alone away from the wall. This helps train anterior-posterior balance. This should be carried out without any motion in the feet. The emphasis should be entirely on balance.

The working place may be altered by using the parallel bars. The child starts by holding on to the bars and then progresses by standing without support. Finally he progresses to the center of the room and works for unsupported standing.

When the cerebral palsy child is ready to practice standing balance away from the wall, the use of skis will be of value in the training. These are made for the particular needs of the individual being trained. A child who has extreme difficulty in learning anterior-posterior balance will do better if his feet are securely strapped in place to the center of two boards, one for each foot. (For construction, see Apparatus and Equipment.)

These skis may have poles inserted in the front of the boards in order that the child will be able to start this standing work by holding on. If the skis can be

made with removable poles the same pair may be used when child is ready to stand without support. Having removable poles is a time-saver. Sometimes standing without support will prove unsuccessful and poles will have to be used again in the same treatment period.

With the completion of this step in balance training the child is ready to be trained for walking.

The use of a mirror is a great aid in teaching balance and should be used whenever possible for all types of cerebral palsy.

Athetoid

Since balance is disturbed chiefly by the involuntary motions, the athetosis must first be diminished to a minimum degree before balance training can be started. In a great many cases, leg braces are used to control the athetosis in the legs and are very necessary if standing is to be accomplished. Elbow extension cuffs may also be applied to help control the involuntary motions of the arms.

Athetoids must learn to contract voluntarily the muscles necessary to maintain balance. However, these muscles need contract only to a small degree for the purpose of retaining balance. It is important, with the athetoid, to start with the upper part of the body first before attempting any standing work. The treatment should be started in a sitting position. For sitting balance a relaxation chair is of great value.

The entire body should be supported, in the beginning, with the exception of the head. By tying the child in and using sandbags, concentration may be focused entirely on head balance. The Alexander Belt may be used to enforce this training.

Progression is made by freeing child farther down until he is able to acquire a sense of balance while sitting. Different types of chairs may be used when balance becomes controlled, until the child is able to main-

tain a sitting position on a stool or while sitting over the edge of the treatment table.

Kneeling balance follows and final training is given in a standing position, training these activities as explained previously.

Spastic

As has been stated before, fear is highly developed in the spastic child and particularly fear of falling. A change of position should never be attempted unless the spastic is told about it. A good deal of time should be spent in explanation of this modality.

Spastics in general need to learn a fine balance sense because their involvement lies directly in the muscles. When a spastic goes off balance and attempts to control this action by pulling back to a straight line, a stretch reflex occurs, blocking his own attempt to straighten up. Also, the spastic usually waits until he is far off balance before doing anything about it. He must, therefore, learn through training a rapid response at the very instant he starts to lose his balance, so that any muscle contraction necessary for control of balance will be so small that stretch reflexes will not occur.

Because the spastic does not have the wild, involuntary motions occurring continuously, the trainer does not have to start the training as rigorously as with the athetoid. Sitting balance may be introduced with the child sitting over the edge of the treatment table, rather than strapped in a chair.

In some instances, a spastic learns a quicker sense of balance by having his balance disturbed. This can be brought about by pushing his body gently in all directions and it teaches him to return to a mid-line position. It is necessary that he be pushed gently; to assure this, the trainer's hand must never leave his body. With this method the child soon learns how to sit alone and can gradually master balance control against a greater amount of disturbance without the protection of the



Fig. 40—Combining hand grasp with standing balance teaches future assisted walking. Emphasis can be placed on hand grasp when feet are strapped down in "foot fixation board." The slits in wood strips make foot size adjustable.

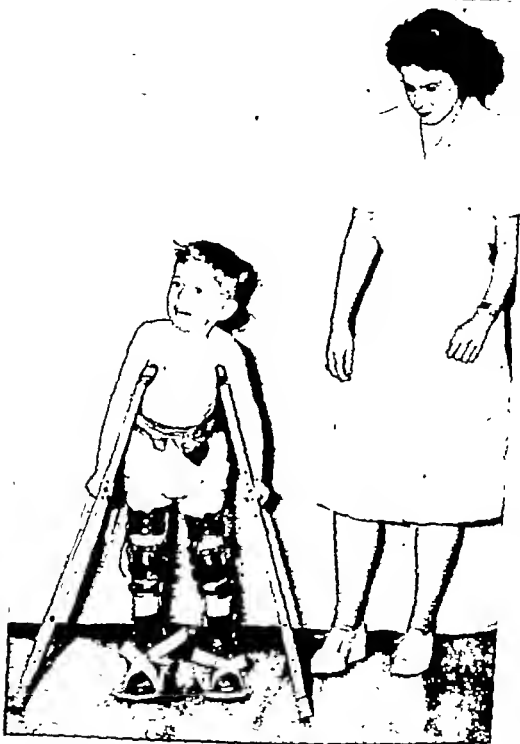


Fig. 41—Learning standing balance by the use of crutches.



Fig. 42—Standing balance holding on to overhead ropes teaches a finer sense of balance when body can be easily disturbed. This equipment can also be used for walking since top ring slides along top rail.



Fig. 43—Standing balance with legs and hips controlled by double bar caliper braces with a pelvic band attached.



Fig. 44—The "St. James Stabilizer" stabilizes legs for standing balance and frees the upper part of the body. An additional treatment feature is that crutch-preparation activities, with special reference to arm and hand coordination, can be trained more easily with the use of this apparatus.

trainer. This technique may also be used when standing him against the wall and finally when he is able to stand unsupported. Also, when hand and arm control is good, crutches may be used to advantage for training in standing balance. The child should stand with crutches and, by placing them well in front, then in back and way out at the side, a better feeling of balance can be understood.

Other than these few irregularities, balance should be taught as it has been outlined previously. Any appliances such as braces, extension cuffs, and skis may be used at the trainer's discretion.

Ataxic

The ataxic child must be trained painstakingly for a sense of balance. The balance mechanism can be trained voluntarily and, with repetition, will become habitual. The ataxic has no involvement of joint or muscle, but he does have an injured balance mechanism so he must be made aware of balance changes by experiencing them; then he must be taught to correct these changes by contracting voluntarily the proper muscles. This may be accomplished by having the trainer disturb the balance. This phase of training is not particularly difficult for the ataxic but it requires time and patience on the trainer's part.

The training should begin with trunk balance. This can be given with the child sitting over the edge of the treatment table. By placing an object on the top of the child's head a finer sense of balance is taught. Since the ataxic has no natural sense of balance, a ball would make the exercise very difficult. A hat would probably have to be used first and continued until control is such that a ball could be substituted.

Kneeling balance would follow this training, and, when the child is able to kneel against disturbance brought about by the trainer, a ball placed on the head and

successfully controlled would continue the training of a fine balance sense.

Standing balance, which follows, would be given in the same manner.

The ataxic, when placed on his feet, will tend to stand with the legs greatly abducted because it broadens his base of support. This abduction should gradually be lessened until the patient is able to assume a natural standing position.

The child should work in front of a mirror at first and should gradually learn to work without it.

Leg braces and skis are an aid for training in standing balance and may be used for the ataxic also.

CHAPTER XX

RECIPROCATION

Reciprocation for all cerebral palsy children is an important phase of treatment if walking is to be accomplished. Most of these cases do not walk prior to having treatment.

Reciprocation of the legs is a physical act which is ordinarily learned by the infant when he kicks his covers off. It becomes more highly developed when the child crawls. For the cerebral palsy victim, these activities are not learned if the motor handicap involves the arms and legs. Therefore, by not learning these actions automatically, the cerebral palsy is delayed and must be taught reciprocation if he is to walk.

Alternation and reciprocation are two entirely different motions and should not be confused. The trainer must be aware of the difference and insist upon the desired action which is reciprocation. Reciprocation must be imprinted on the child's mind until the action becomes automatic.

Alternation is accomplished by moving one *extremity* and then the other. For instance, if alternation was desired for hip flexion, it would be brought about by lifting one leg up from the table and then down. When it assumed its *resting position*, the other leg would then be raised in the same manner and lowered. This motion would be an alternating one. For the action of reciprocation of the same motion one leg would be raised and, at the same time the raised leg was started downward toward the table, the other leg would be raised. Both legs move at the same time but travel in opposite directions. This is the motion of reciprocation.

When the cerebral palsy patient is ready to begin exercises, reciprocal motion should be stressed whenever



Fig. 43—Walking in parallel bars teaches reciprocation. The slip grip slides along bar and enables child to place his full attention on legs since the hand does not have to lift off of bars.

possible since one leg is never used without the other in walking.

The trainer will discover, however, that there will be cerebral palsy cases in which reciprocation cannot be used immediately, due to the marked degree of involvement in a given part of the body. When this is so and an exercise is desired, the extremity should be exercised singly, never with alternating motion. Alternating motions have no value and, if taught, must usually be unlearned in order that reciprocation can be taught later. It is considered an indirect method of teaching.

Gravity has a definite influence on reciprocation. In any given action, the parts moving reciprocally must at same time work against gravity. The trainer must observe the strength or weakness of the muscles working against gravity and, when necessary, stop the activity and return to placing stress on building up muscle power needed for the specific muscles. If this is done, reciprocation will be trained in more readily. There must be twice as much power in the antigravity muscles as there is in the progravity muscles.

Timing of muscle action is also of great importance if the reciprocal action is to be smooth. The patient must learn to "let go" of a muscle at the proper rate of speed at the same time its antagonist contracts.

Teaching walking with patient in a pool is of no value since gravity is eliminated. The same is true when a "walker" is used. No appliances should be used for walking if the use will change the gravitational pulls needed for walking. Gravity must be present in order to give the child a true picture of the act of walking. The legs should be exercised with the child in both supine and prone positions so that the child gets the full range of motion, the same range of motion that he will use when he walks.

Skis are used largely for training in reciprocal leg action when walking is introduced. They have two advantages; one, faulty conditions of the feet may be



Fig. 46—The "abductor board" keeps legs apart while walking. This patient is also correcting foot position by the use of twistlers.

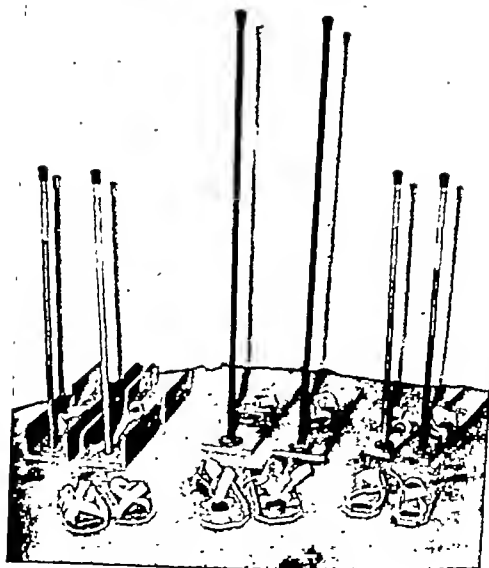


Fig. 47—Specially constructed graded skis.



Fig. 48—Walking with a tripod crutch this patient learns a reciprocal hip pattern.



Fig. 49—Walking is accomplished with the aid of small slis which are worn at all times. The helmet protects the head when child falls and aids in lessening fear of falling.

corrected and, two, reciprocation may be developed. Skis, if constructed to take care of the individual child, keep feet from turning in or out, give the added control needed in order that the feet remain on floor, and maintain good alignment to the legs. When skis are used, the child is taught to slide one foot ahead of the other and there can be successful operation only if a reciprocal motion is taking place. Child would not be able to accomplish this activity of putting one foot ahead unless the other foot were back. Therefore, the action of hip flexion and extension is reciprocal.

Leg braces and extension cuffs for the knees may be used for this training in order that the child's complete attention may be focused on the hip action.

Reciprocation is used mainly for the hips and shoulders and any starting exercise for these parts should always be done reciprocally. The spastic child has a tendency to copy with one hand what he is doing with the other. For instance, when doing finger flexion and extension with one hand, he will simultaneously carry on the same motion with the other. When this occurs, reciprocation is taught to all parts of the body for the purpose of making the motions reciprocal and not simultaneous. This breaks up the copy pattern.

This modality is an important one for all cerebral palsy victims and is introduced when training is first started. The conditioned exercises, mentioned in an earlier chapter, develop reciprocal actions and those exercises are the ones to be used when the child is ready for reciprocation.

CHAPTER XXI

REACH AND GRASP

Reach and grasp is as important to the arms as reciprocation is to the legs. It is practically the last step in the physical therapy treatment for all cerebral palsies and deals with the arms only. Reach and grasp is learned by the normal infant about the same time he learns to kick his covers off. However, the child with cerebral palsy who is unable to move his hands and arms freely, due to a motor disturbance, does not learn to reach and grasp.

This modality teaches the cerebral palsy patient the use of the arm as a whole. It requires a combination of joint motions and is not introduced in treatment until single joint motions can be performed actively. When the cerebral palsy child reaches this stage in his training, combined motions involving two or more joints in one extremity may be started. This modality is best given with the patient in a sitting position, since this is the natural position for such activities to be carried out.

Reach and grasp may begin by combining two motions and, at first, may be given passively by the trainer. When this can be accomplished actively, the training should proceed by combining three motions and then four, until all the motions in the arm and hand become coordinated, making reach and grasp possible.

This is an important modality, not only because the arms and hands are put to good use, but it also establishes a joint consciousness. In some instances, a tenseness is needed in a joint in order that another action may take place in the same extremity. For example, when performing ordinary forward flexion of the shoulder, it is necessary to tense the rotators in order to keep the

humerus from rotating. This tensing of other muscles is a combined motion.

It should be remembered that one side of the body leads and the other side assists. For most activities the child should be taught to use the assisting arm for the aid while the leading arm executes the important part of the action.

Also, with this modality, the trainer can show the desired action by self-demonstration. In other words, the cerebral palsy child may be taught the natural way by the trainer. This is the only time in the treatment that an activity can be taught in this way.

This modality requires a good amount of muscular control and should be continued only if the patient is able to maintain control. The approach is the same for all cerebral palsy conditions with emphasis placed on different things.

The main purpose of reach and grasp is to teach the patient to use his hands and fingers for the act of grasping and releasing. The elbow and shoulder, likewise, are combined with these parts, in order that the grasped object may be carried to and from the body and released in the proper place, making the act complete and useful.

Prior to learning this modality the cerebral palsy patient has been taught to perform the simple joint motions in the arms by means of routine exercises. With this new phase of treatment each case differs. Since there are no two cases alike, the trainer must plan the specific motions most desirable for the individual and must teach him the combinations of motions that will help him in his everyday routine of living; such activities as feeding, dressing, typing, et cetera.

CHAPTER XXII

SKILLS

The training of skills follows the modality reach and grasp and is the final step in the treatment for the cerebral palsy child. A skill is taught when joint motions in an extremity can be performed with ease and control.

A skill is nothing more than an ordinary, everyday activity which the cerebral palsy child must learn. It is wise to start by teaching simple skills but only those most important to the individual; the latter to be governed by his needs.

When the teaching of a skill is first introduced, the child should be placed in a position which will assure his full attention for the skill. If sitting requires help and the child has to divide his attention to maintain that position, then the skill should be started in a lying position and progressed to a relaxed sitting position. This will probably prove true with the athetoid and nonintension tremor more than with the spastic or ataxic. Anything else which may be upsetting should be eliminated. All arrangements should be made conducive to the child's control.

Sandbags may be applied to other parts of the body to assure control, then removed as soon as possible.

Another method for maintaining control is to break down the skill when starting, by making the task as easy as possible. For instance, when teaching the child to lace a shoe, introduce it by working with a constructed wooden shoe nailed down to a board to make it immovable. The holes through which the laces go may be large with somewhat smaller laces. (Shellac on the tips of the laces makes control more easily mastered.) When this can be accomplished satisfactorily, progression is

made by using smaller shoe, smaller laces, and with the shoe still nailed down. This can be followed by using an ordinary shoe, regular size laces, and with the shoe free to move. The steps of progression should be graded so that control may be maintained throughout the activity or there will not be any carry-over outside the treatment room. The important thing to remember when teaching skills is to train the cerebral palsy child by placing the object in its natural position. The training for shoe lacing just described should be practiced with the back of the shoe facing the child. He learns to lace it as he would if it were on his own foot. The final step of this training would be to have the child lace his own shoe on his foot.

Shoe-lacing is an essential activity and must be executed in the child's life at least once a day. It is, therefore, a worthwhile skill for him to learn. There are a great many activities which can be given that will require as much coordination and muscular control as are evidenced when learning shoe-lacing, though having almost no value for learning everyday activities. Weaving, for example, can be set up in such a way that it will take care of all the needed muscular actions, but it is not a necessary function and would, for the most part, be a waste of time. The cerebral palsy patient has so much to learn just to become self-sufficient that the time should be spent working toward this goal. However, if all functional activities can be accomplished to the trainer's satisfaction, and a finer coordination is desired, weaving could be given as a polishing-up exercise.

Some of the useful skills that can be used in training the cerebral palsy children are as follows:

1. Feeding

- a with spoon
- b with fork
- c with knife and fork (cutting)
- d drinking out of cup

CHAPTER XXII

SKILLS

The training of skills follows the modality reach and grasp and is the final step in the treatment for the cerebral palsy child. A skill is taught when joint motions in an extremity can be performed with ease and control.

A skill is nothing more than an ordinary, everyday activity which the cerebral palsy child must learn. It is wise to start by teaching simple skills but only those most important to the individual; the latter to be governed by his needs.

When the teaching of a skill is first introduced, the child should be placed in a position which will assure his full attention for the skill. If sitting requires help and the child has to divide his attention to maintain that position, then the skill should be started in a lying position and progressed to a relaxed sitting position. This will probably prove true with the athetoid and nonintension tremor more than with the spastic or ataxic. Anything else which may be upsetting should be eliminated. All arrangements should be made conducive to the child's control.

Sandbags may be applied to other parts of the body to assure control, then removed as soon as possible.

Another method for maintaining control is to break down the skill when starting, by making the task as easy as possible. For instance, when teaching the child to lace a shoe, introduce it by working with a constructed wooden shoe nailed down to a board to make it immovable. The holes through which the laces go may be large with somewhat smaller laces. (Shetlac on the tips of the laces makes control more easily mastered.) When this can be accomplished satisfactorily, progression is

made by using smaller shoe, smaller laces, and with the shoe still nailed down. This can be followed by using an ordinary shoe, regular size laces, and with the shoe free to move. The steps of progression should be graded so that control may be maintained throughout the activity or there will not be any carry-over outside the treatment room. The important thing to remember when teaching skills is to train the cerebral palsy child by placing the object in its natural position. The training for shoe lacing just described should be practiced with the back of the shoe facing the child. He learns to lace it as he would if it were on his own foot. The final step of this training would be to have the child lace his own shoe on his foot.

Shoe-lacing is an essential activity and must be executed in the child's life at least once a day. It is, therefore, a worthwhile skill for him to learn. There are a great many activities which can be given that will require as much coordination and muscular control as are evidenced when learning shoe-lacing, though having almost no value for learning everyday activities. Weaving, for example, can be set up in such a way that it will take care of all the needed muscular actions, but it is not a necessary function and would, for the most part, be a waste of time. The cerebral palsy patient has so much to learn just to become self-sufficient that the time should be spent working toward this goal. However, if all functional activities can be accomplished to the trainer's satisfaction, and a finer coordination is desired, weaving could be given as a polishing-up exercise.

Some of the useful skills that can be used in training the cerebral palsy children are as follows:

1. Feeding

- a with spoon
- b with fork
- c with knife and fork (cutting)
- d drinking out of cup

- e drinking out of glass
- f drinking with glass straw
- g drinking with paper straw

2. Dressing

- a buttoning (practice board)
- b unbuttoning (practice board)
- c placement of clothing on practice doll (life size)
- d placement of clothing on self
- e buttoning clothes on self
- f unbuttoning clothes on self
- g lacing shoe (practice board)
- h lacing shoe on self
- i opening zipper (practice board)
- j opening zipper on self
- k closing zipper (practice board)
- l closing zipper on self
- m fastening straps and buckles (own braces if worn)

3. Brushing and combing hair

4. Brushing teeth

5. Writing

- a on blackboard (big chalk)
- b on blackboard (regular size chalk)
- c on paper (between wide lines)
- d on paper (between regular size lines)
- e on paper (no lines)

6. Typing

- a with specially built table (sunken typewriter)
- b without special table

The cerebral palsy patient will require a long time to complete these tasks. The length of time needed should be noted by a graph. Timing should be emphasized from the beginning, and the child should be aware of it. If it takes him all day to dress himself, then he

certainly has not learned the skill because it will be of no value to him.

While the child is learning skills he should not be made to perform them at home. Not until he can do them with a certain amount of success should they be put to practical use. If he is forced to practice at home less effort will be put on this training when he is in the treatment room. The trainer, therefore, should notify the mother when the child is finally ready to put a learned skill to use and, when this occurs, another skill should be introduced in treatment. It is not necessary, however, to wait until the skill has been entirely learned before putting it to use outside of the treatment room.

Training of a skill should be discontinued as soon as it can be accomplished by the child in the specified time. It is important to remember to treat such skills as feeding, dressing, and writing as necessary acts and not as outstanding feats of performance. Too much praise and commendation will increase self-consciousness and, as a result, the motions will become uncontrolled. This should be remembered in the home as well as in the treatment room, if the best results are to be obtained.

It has been observed that the child will progress faster if a skill is practiced at any time of the day other than the time provided by routine. Feeding should not be taught at meal time. The child may grow to dislike his food; the food served at the meal may be too difficult for him to manage. He should not have the unpleasant association of eating as connected with treatment.

It is important, then, when teaching skills, to keep them apart from the child's everyday routine until they can be mastered satisfactorily. When a skill can be put to good use the child no longer requires training for it.

CHAPTER XXIII

CEREBRAL PALSY TRAINERS

The job of teaching a cerebral palsy patient to become self-sufficient is arduous, painstaking and long, but, when completed, it is rewarding in itself. The field is comparatively new and its growth is inevitable, due to the growing body of information and the number of untouched treatable cases.

To date there are few doctors who fully understand the treatment and so, for the most part, the responsibility rests with the trainer. For this reason alone the person treating the cerebral palsy patient must have a complete understanding of the explored field and should have ingenuity as to its possibilities. The trainer must be able to start the treatment; decide the treatment aims, from both the physical and economic viewpoints; detect all faults, physical and sensory, (sight and hearing usually). This responsibility makes a genuine liking for this type of work a prerequisite.

It is obvious that a thoroughly trained person is needed if satisfactory results are to be obtained from the training given to the cerebral palsy patient. The trainer has so much responsibility that it is necessary that she have a solid foundation before teaching the treatment. Physical therapy is a basic requirement since treatment of cerebral palsy makes use of its tenets. By first learning physical therapy a person is well qualified to take up the further study of cerebral palsy.

In addition, the person who goes into the cerebral palsy field should have certain personal qualifications. She should be even-tempered, calm under confusion and pressure, since she is working with children who are constantly thwarted by not being able to make the motions that they wish to make. She should be so patient

that she can work for hours to train a child to accomplish one small physical act, such as balancing the head on the body. Her voice should be clear and modulated, controlled always to the point that the child is never given a shrill or explosive command.

She should learn to see each child objectively and have enough psychological training combined with an inherent interest to understand the varied problems of each. She should accomplish a sympathetic trainer-pupil relationship and yet not show sympathy. She should impress the child that the relationship is a working one and not a play relationship. Professional dress and treatment rooms with a business-like air automatically help this treatment attitude.

The treatment in this book has referred to a certain technique for the cerebral palsy child. There are, in addition, adult cerebral palsy patients who are treatable. The war has created many; disease is responsible for others.

Cerebral palsy treatment is a specialized field which needs specialized study. There are few instructors and comparatively few trainers at the present time. It provides a rare field for the persons who are interested in professional frontiers.

APPARATUS AND EQUIPMENT

Abductor Board

1. Walking with legs held in slightly abducted position
 - a. Width of floor board 20" wide, 7' long with a perpendicular board $\frac{5}{8}$ " thick arising from center of floor board about 15" high
 - b. Walking with support in parallel bars
 - c. Walking without support in center of room

Alexander Ball

1. Rubber ball (tennis size ball) cut in half
 - a. Head control and balance

Body Brace

1. Taylor brace
 - a. Two bar back brace
2. Knight brace
 - a. Four bar back brace
3. Back brace attached to leg braces

Chairs

1. Constructed
 - a. Sloping back and seat
 - b. Built up sides
 - c. Foot holders for strapping down feet
 - d. Arm rests
 - e. Canvas inserts for back of head
 - f. Doudoir chair

Corset

1. Boned
2. Elastic

Crutches

1. Full length
2. Half crutch
3. Crab crutch (three point base)
4. Cane

Exercise Board

1. 24" by 31"
2. Very smooth
3. Highly polished

Exercise Rings

1. A circular wire about 7" in diameter padded with sheet wadding, cotton, gauze and covered with stockinette
 - a. Used for hand grasp
 - (a) during bed exercises
 - (b) aid for balance

Extension Cuffs

1. Corrugated paper reinforced by screening with the edges bound by adhesive tape and applied by molding around the part to be held in extension by an ACE bandage
 - a. Elbow extension cuff
 - (a) from middle of upper arm to mid forearm
 - b. Knee extension cuff
 - (a) from mid thigh to lower part of calf

Foot Fixation Board

1. A flat board with foot inserts (size of shoe)
 - a. For the purpose of strapping the feet down when training in standing balance

Foot Stools

1. Varying heights and widths

Goniometer

1. For joint measurements

Metronome

1. For timing purposes
2. For rhythm

Mirror

1. Over head (on ceiling)
2. Full length (on wall)
3. Movable
4. Speech

Parallel Bars

1. Small size
 - a. 24" high, 20" wide, 7' long or longer
2. Medium size
 - a. 30" high, 23" wide, 7' long or longer
3. Large size
 - a. 35" high, 26" wide, 7' long or longer
4. Slip grips for hand grasp
 - a. Light weight metal molded around bars, loose enough so that they can slide up and down bars freely
 - b. For the patient who requires assistance with hand grasp while walking

Pillows

1. Large size (two per treatment table)
2. Small size (three per treatment table)

Powder

1. Any sprinkling kind

Practice Stairs

1. Stationary
2. With railings
3. Regular size steps
4. With a landing on the top

Stools

1. High enough for trainer when working at the treatment table
2. Low one on wheels for trainer

Thermometer

1. Body
2. Room

Treatment Table

1. 72" long, 36" wide, 32" high up to table top, not including mattress
2. Firm surface
 - a. smooth
 - b. smooth sheet

Tricycle

Twisters

1. For the purpose of correcting inversion or eversion of the feet
 - a. Place a buckle on the outside of the shoe at the proximal joint of either the big toe or little toe depending upon the desired correction. Insert elastic webbing 1" wide and wind around the leg once or twice, going upwards toward the hip. Attach to a binder which should fit snugly around the lower trunk, and attach the webbing to any part of the binder allowing the proper amount of pull needed to correct the foot position. The position of the feet should correct immediately after the twister is applied, and until this is brought about continue changing the arrangement of the twister

Webbing Strips (binder)

1. A piece of canvas about 27" long, and about 12" wide, with straps on one end, and buckles on the other, and strapped around two upright stationary poles, or at one end of the parallel bars
 - a. Knee bracer for standing practice

Weighting Scale

Sheets

Pillow Cases

1. Large
2. Small

Mattress

1. Rubberized mattress cover

Pelvic Binders

1. Large
2. Medium
3. Small

Kleenex

Scissors

1. Bandage
2. Shears (large)

Sewing Equipment

Adhesive Tape

1. Varied widths

Webbing

1. Plain 1"
2. Elastic 1"

Buckles

1. Single
2. Sliding
3. Double

Sheet Wadding

Cotton

Canvas (material)

Muslin (unbleached)

Alcohol (rubbing)

Alcohol and Alum (skin toughener)

Ace Bandages

Gauze

1. Rolls
2. Squares
 - a. large
 - b. small

Stockinette

1. 2" wide
2. 4" wide
3. 6" wide

Felt

Sponge Rubber

Wire No. 4

Wire Screening

Plaster

Stools

1. High enough for trainer when working at the treatment table
2. Low one on wheels for trainer

Thermometer

1. Body
2. Room

Treatment Table

1. 72" long, 36" wide, 32" high up to table top, not including mattress
2. Firm surface
 - a. smooth
 - b. smooth sheet

Tricycle

Twisters

1. For the purpose of correcting inversion or eversion of the feet
 - a. Place a buckle on the outside of the shoe at the proximal joint of either the big toe or little toe depending upon the desired correction. Insert elastic webbing 1" wide and wind around the leg once or twice, going upwards toward the hip. Attach to a binder which should fit snugly around the lower trunk, and attach the webbing to any part of the binder allowing the proper amount of pull needed to correct the foot position. The position of the feet should correct immediately after the twister is applied, and until this is brought about continue changing the arrangement of the twister

Webbing Strips (binder)

1. A piece of canvas about 27" long, and about 12" wide, with straps on one end, and buckles on the other, and strapped around two upright stationary poles, or at one end of the parallel bars
 - a. Knee bracer for standing practice

Weighting Scale

Sheets

Pillow Cases

1. Large
2. Small

Mattress

1. Rubberized mattress cover

Pelvic Binders

1. Large
2. Medium
3. Small

Kleenex

Scissors

1. Bandage
2. Shears (large)

Sewing Equipment

Adhesive Tape

1. Varied widths

Webbing

1. Plain 1"
2. Elastic 1"

Buckles

1. Single
2. Sliding
3. Double

Sheet Wadding

Cotton

Canvas (material)

Muslin (unbleached)

Alcohol (rubbing)

Alcohol and Alum (skin toughener)

Ace Bandages

Gauze

1. Rolls
2. Squares
 - a. large
 - b. small

Stockinette

1. 2" wide
2. 4" wide
3. 6" wide

Felt

Sponge Rubber

Wire No. 4

Wire Screening

Plaster

APPENDIX

Organization of a Cerebral Palsy Department In a Children's Hospital

BY MOIR P. TANNER

SUPERINTENDENT OF CHILDREN'S HOSPITAL, BUFFALO

I welcomed Miss Egel's invitation to add a few words about organization of the Cerebral Palsy Department of the Children's Hospital.

While this book is for technicians, there seemed to be some place for a description of the department which we have conducted for over six years. Up to that time most of us knew very little about cerebral palsy. For years these children have been coming to the hospital, both in the in-patient and out-patient department, and it seemed to some of us that if anything could be done for them it was a children's hospital's responsibility.

We gathered all the information we could, and after considerable reading invited Dr. Phelps to come to Buffalo and talk to us about the formation of a department. That brought one of his outstanding technicians in the person of Miss Egel to head the department.

The unit was started in a rather remote part of the hospital on an out-patient level, and many children known to the hospital sought admission to this unit. Other technicians were trained and added to the staff, and within a few months it was determined that many patients had to be in residence at the hospital if they were to receive treatment because their homes were geographically removed from the City of Buffalo.

A ten-bed ward was converted and refurnished for this purpose. The hospital soon needed this space for acute medical work and this unit also had to be aban-

done. The board of managers of the hospital had watched this work grow. They had seen the improvement that many of these children had made and more keenly felt the responsibility that they had in furnishing care for these children.

The medical supervision of the department had been largely confined to interested pediatricians and orthopedists. Dr. Phelps has visited this clinic every six months since its inception.

The hospital purchased a large home in the City of Buffalo, made all of the improvements necessary, and here is the Department of Cerebral Palsy at the present time. There are twenty-two patients living in the building and over sixty patients being treated three times a week on an out-patient basis. School is provided by specially trained teachers for physically handicapped children, provided by the Board of Education of the City of Buffalo.

The medical staff has made as much progress as the physical structure. Now all patients are admitted through the admission clinic, which is held weekly, and here a patient is examined by the pediatrician, the orthopedist, the neurologist, and the child psychiatrist, all staff members of the Children's Hospital. After their consultation it is determined whether or not the patient is trainable. If it is determined that the patient will benefit by the work of the department, he is put on the waiting list for admission, either as an in-patient or out-patient, depending on his residence.

As we have progressed in this work, we have found that there is a great advantage for a department of this kind to be connected with a hospital particularly a children's hospital. All of the clinical facilities of the hospital are made available to the department, and this includes not only the pediatric and all special clinics but the Child Guidance Department with its psychologist and psychiatrist, the Social Service Department, the Department of Electroencephalography and many others.

If parents cannot look to their Children's Hospital for the care of these patients, where are they to seek help? Up to this point there have been very few other sources that could be found. Every one of these small patients is an individual. The hospital must treat them as such. There is no other way that this work can be adequately accomplished. This we have always tried to do, and, I think, has been largely responsible for many of the favorable results that have been obtained.

We know that cerebral palsy is a greater problem, as far as numbers are concerned, than infantile paralysis. We are told by experts that seven out of every one hundred thousand population are cerebral palsy children. One of these infants fails to survive, two are unteachable, another one is so mild that little or no treatment is necessary. This means that in a city the size of Buffalo, there are forty cases added to the population each year who are treatable. That means that there are at least seven hundred to eight hundred children in our city alone that could use advantageously our Department of Cerebral Palsy. It is, therefore, somewhat discouraging to realize that perhaps we are only "scratching the surface" when we attempt to take care of this problem in this meager way, and yet almost four hundred children have been treated in the Children's Hospital Clinic since its inception. Many of these, are from the Western New York area and other parts of the State as well as greater Buffalo.

Many technicians have been trained here and sent to other cities to organize the work or to supplement existing facilities. We believe that this is one of the most important contributions that any clinic can make to the cause of cerebral palsy.

One of the very important factors in the training of these children is the part played by the parent. Here, again, as you will note by Miss Egel's book, individual work has to be accomplished with the parents themselves and this training has to continue after the child leaves the department or between visits to the clinic.

One of the most amazing experiences of my hospital work has been to observe these children being brought to this department for the first time, unable to walk, talk, or to do anything for themselves, and in a period of months many of them are in school being taught, either in the cerebral palsy school or regular public school, taking their place with other children reasonably self-sufficient individuals. When you talk to parents of these patients you realize that not only the child has been rehabilitated but so has the entire family. I only wish that all children's hospitals in the country could see their responsibility in the field, not only of Cerebral Palsy, but in all chronic conditions of children. It is a responsibility that we can no longer ignore.

Dr. Phelps urged us to form a parent group in order that we might interpret the work in the department more accurately to the parents of the children being treated in this department. This was done with very little difficulty. These parents have shown a profound interest in the organization, which they themselves have developed. The group started very largely on a Parent-Teacher basis, and here parents, after formal meetings, had an opportunity to talk with school teachers, technicians, nurses, and others caring for their children.

An ambitious program committee saw to it that each meeting held a new experience for these parents, and many physicians and others, who could add to the training both of the child and parent were brought to these meetings for formal talks and informal discussion periods. From this organization developed the Cerebral Palsy Association of Western New York. This is an organization with many committees of public relations, legislation, and others and it has done a big job of interpreting cerebral palsy to the area in which they live. I am sure it is safe to say that this group, to a large extent, formed a nucleus of the state organization for cerebral palsy. Little did any of us realize in forming a parent organization of this kind that we were really accomplishing pioneering activities.

This organization now, with the help of the hospital's department has prepared a motion picture which interprets the care of the cerebral palsy patient, and this has already been shown to many hundreds of interested people in all parts of New York State. I cite this only as an example of what an organization of this kind can accomplish. It must be so much easier now to establish a Department of Cerebral Palsy, because of the tremendous strides that have been made in these past two years. The advances not only in treatment but in the understanding of the problem would seem to make the formation of a department possible in almost any city. It is undoubtedly not necessary that a unit of this kind be located in a hospital or perhaps not necessary to be under the jurisdiction of a hospital, the advantages are great but not entirely essential.

The greatest problem is to secure well trained, competent technicians to accomplish the physical therapy, the occupational therapy, and the speech therapy as well as school teachers, who have been properly trained and thoroughly understand the cerebral palsy child. Physicians, of course, are essential to organize and guard the destinies of a department of this kind. It is encouraging to note that more and more physicians are studying the cerebral palsy problem, which will make available to many communities even a better Department of Cerebral Palsy than we possess in Buffalo.

The expense of a unit of this kind is a matter of some concern. Patients are admitted as private cases, if parents can afford this terrific burden. If not they are taken care of through the facilities of the State Aid Program of the Department of Health of the State of New York. It seems that with the number of attendants and others necessary to operate a unit of this kind, plus the professional personnel, one employee per child is almost the least that can be counted upon to do any kind of an adequate job.

Our unit in its new quarters for its first year of operation has shown a deficit of over \$15,000. An expense of

this kind causes a hospital some difficulty. There is also the huge expenditure for buildings and improvements which the Board of Managers of the hospital could only find in their Endowment Fund, and it could be used for no better purpose.

Realizing that the hospital was carrying a large financial burden, and realizing the advantages that a department of this kind can give to a community, the Variety Club of the City asked the hospital to allow them to pay the deficit of the department, and so now there is a large sign over the door which reads: "The Variety Club Department of Cerebral Palsy of the Children's Hospital." More and more organizations are going to find that they will serve a greater purpose in the world by taking on a responsibility of this kind.

We realize, despite the fact that we have made some strides in these past six years, that there is still a long way to go. A unit of this kind must keep pace with the progress made in its field, and in the past three or four years that progress has been great. The next three or four years will undoubtedly record even greater advances. To be sure, the hospital is rather proud of its department, and credit for the organization must go very largely to a Board of Managers who had the vision to see a large community responsibility, and certainly to the Director, who has given over six years of herself to the organization and development of the department. I am sorry for all the Departments of Cerebral Palsy in the country which cannot have the director who has been prevailed upon to write this book for technicians.

INDEX

A

- Active assisted motion, ataxia, treatment of, by, 66, 67
 athetoid, treatment of, by, 64, 66
 conditioned motion, use of, in, 76, 78
 description of, 62
 extension cuffs, use of, in, 64
 pulleys, weighted, use of, in, 64, 67
 spastic, treatment of, by, 63, 64
 summary of, 67
 tremor, in, 66
 motion ataxia, treatment of, by, 71, 72
 athetoid, treatment of, by, 70, 71
 braces, use of, in, 71
 conditioned motion, use of, in, 70
 description of, 68
 extension cuffs, use of, in, 71
 pulleys, use of, in, 71
 sandbags, use of, in, 71
 spastic, treatment of, by, 70
 summary of, 72
 tremor, in, 71
 Alexander ball, (see Apparatus and equipment, 184)
 ataxia, treatment by use of, 166
 balance, training by use of, 156, 159
 Alternation, not desirable motion to treatment, 168, 170
 Ataxia, active assisted motion, use of, in, 66, 67
 motion, use of, in, 71, 72
 balance, training of, in, 166
 combined motion, use of, in, 125, 127
 conditioned motion, use of, in, 80
 description of area-damaged in, 22, 166
 massage, use of, in, 50
 muscle examination for, 44, 45
 passive motion, use of, in, 60

Ataxia—Cont'd

- personality of, 28, 29
 resisted motion, use of, in, 75
 rest, use of, in, 128
 skills, use of, in, 178
 Athetoid, active motion, use of, in treatment of, 62, 64
 area damaged in, 21
 balance, use of, in treatment of, 159, 160
 combined motion, use of, in treatment of, 125
 conditioned motion, use of, in treatment of, 77, 80
 description of, 24, 25
 extension cuffs, use of, in treatment of, 59, 64, 146, 147
 massage, use of, in, 49, 50
 muscle examination form, (see Joint motion muscle examination, 43)
 examination of, 41, 42, 43
 overflow in, 25
 passive motion, use of, in, 57-59
 personality of, 27, 28
 relaxation, use of, in treatment of, 138
 resisted motion, use of, in treatment of, 75
 rest, use of, in treatment of, 128, 131
 sandbags, use of, in treatment of, 58, 146, 147
 akitsis, use of, in treatment of, 178
 tension and nontension, 25
 Automatic or confused motion, cases illustrated, in, 120, 121
 early finding of, 119
 purpose of, 118
 summary of, 123
 treatment of, 120
 use of, 118, 119

B

- Balance, Alexander ball, use of, in, 156, 159
 ataxia, treatment of, in, 166, 167

Balance—Cont'd

- athetoid, treatment of, in, 159, 160
- crawling, use of, in, 150
- kneeling, use of, in, 156, 158, 160
- parallel bars, use of, in, 158
- purpose of training in, 155
- sitting, use of, in, 150, 159, 160
- skis, use of, in, 158, 159
- spastic, treatment of, in, 100
- standing, use of, in, 158, 160
- Birth-injured, possible activity determined at various age levels, 18
- Board, polished, description and use of, 78, 79
- Bobby Shafto, leg training, by use of, 110
- Braces, active motion, treatment in, by use of, 70, 71
- automatic or confused motion, treatment in, by use of, 123
- balance, training in, by use of, 159, 166, 167
- conditioned motion, treatment in, by use of, 78
- description of use, 53
- motion from the relaxed position, treatment in, by use of, 153
- reciprocation, training in, by use of, 175
- relaxation, training in, by use of, 140, 147
- resisted motion, avoidance of, by use of, 73
- rest, training in, by use of, 128
- stretching, by use of, 57
- Brain, damage to, 17, 21
- various conditions resulting in, 20

C

- Cerebral palsy, active assisted motion, use of, in treatment of, 63
- motion, use of, in treatment of, 68
- balance, Alexander ball, use of, in treatment for, 150
- crawling, training in, in treatment for, 150
- head, training for, in treatment for, 150, 159

Cerebral Balance—Cont'd

- need of, training in, 155
- parallel bars, use of, in treatment for, 158
- sitting, training in, in treatment for, 156, 159
- skis, use of, in treatment for, 158, 159
- standing, training in, in treatment for, 158
- combined motion, use of, in treatment of, 124
- conditioned motion, use of, in treatment of, 76, 77, 81, 82-117, 175
- definition of, 20
- massage, use of, in treatment of, 48, 50
- metronome, use of, in treatment of, 52
- passive motion, use of, in treatment of, 51, 57
- reach and grasp, in treatment of, 176, 177
- dressing, use of, in, 177, 179
- feeding, use of, in, 177
- typing, use of, in, 177
- reciprocation, use of, in treatment of, 176, 177
- resisted motion, use of, in treatment of, 73
- rest, use of, in treatment of, 128, 131
- skills, use of, in treatment of, 180, 181
- Children's Hospital, Buffalo, New York, probationary period, 19
- Clonus, description of, 39
- Colby, Miss Jenny, 77
- Combined motion, description of, 124, 125, 175, 176
- purpose of training in, 124
- summary of, 127
- treatment in, 124, 125, 127, 170, 177
- Conditioned motion, explanation of, 76
- handedness, use of, in, 78
- purpose of training in, 81
- rhymes, use of, in, 76, 77, 78
- treatment in, 82-117, 175
- Confusion, definition of, 119
- Constrained motion, purpose of, 120

Crawling, developing walking pattern by training in, 168
purpose of training in, 156
treatment in, 156, 160
Crutches, balance, training in, by use of, 166

D

Dressing, reach and grasp, use of, in teaching, 177
skills, use of, in teaching, 178, 180

E

Education, 33, 34
Exercises, arms, beginning, use of, in, 79, 80
description of, 77, 82-117
legs, beginning, use of, in, 79, 80
relaxation, use of, in, 145
Extension cuffs, (see Apparatus and equipment, 185)
balance, training in, by use of, 159, 166
motion from the relaxed position, training in, by use of, 153
reciprocation, training in, by use of, 175
relaxation, training in, by use of, 146, 147
use of, 59, 64, 70, 71, 78

F

Feeble-mindedness, athetosis, not result of injury in, 21
early misinformation on, 17
spastic, not characteristic of, 18
treatment generally valueless, 23
Feeding, reach and grasp, use of, in training of, 177
skills, use of, in training of, 179, 180, 181

G

Gallop trot, leg training, by use of, 98
Goniometer, 40
Gravity, avoidance of "pool" training, 170
of use in active motion, 69, 70, 71
of "walker" training, 170
use of, in active assisted motion, 62

Gravity, use of, in—*Cont'd*
balance, 155
reciprocation, 170
treatment of O.C. muscles, 120
Grind the Coffee, arm training, by use of, 104

H

Handedness, conditioned motion, use of, in, 76
reach and grasp, use of, in, 177
Hemiplegia, 32

I

Involuntary motions, avoidance of, in active assisted motion, 62, 64
motion, 68
in balance, 159
in combined motion, 125
in relaxation, 139
in resisted motion, 73
in rest, 128
cause of, 21
in athetoids, 25, 41, 57
in types of tremor, 21
use of, in resisted motion, 75

J

Jacobson, Edmund, author of "Progressive Relaxation", 132
Joint motion muscle examination form, 43
explanation of use of, 42

K

Kinesthetic sense, description of, 22
in ataxia, 60, 72, 125, 127
Kneeling, purpose of training in, 156
treatment in, 156, 158, 160, 166

L

Lateral tracing, 40
Little Birdies, arm training, by use of, 94
leg training, by use of, 114
Little's Disease, 17
Lord, Elizabeth, 19

- Massage, purpose of, 48
 use of, in treatment of ataxia, 50
 athetosis, 49, 50
 O. C. muscles, 123
 spasticity, 48, 49
 summary of, 50
 tremor, 50
- Metronome, use of, 52, 68
 in active motion, 68
 in relaxation, 146
 in treatment of athetosis, 52, 59
 spasticity, 52
- Mirror, use of, 78
 in balance, 159, 167
 in relaxation, 130, 142
- Modalities, active assisted motion, 62, 67
 motion, 68-72
 automatic or confused motion, 118-123
 balance, 155-167
 combined motion, 124-127
 conditioned motion, 76-117
 definition of, 46
 massage, 48-50
 motion from the relaxed position, 152-154
 passive motion, 51-61
 reach and grasp, 176-177
 reciprocation, 168-175
 relaxation, 132-151
 resisted motion, 73-75
 rest, 128-131
 skills, 178-181
- Monoplegia, 32
- Motion from the relaxed position
 in athetoid, 152, 153
 purpose of, 152, 153
 summary of, 154
 treatment by, 152, 153
- Muscle examination, for ataxia, 44, 46
 athetosis, 42, 43
 O. C. muscles, 39, 118
 spasticity, 30, 37, 38
- Muscles, understanding of, 20
 in athetosis, 24
 in relaxation, 132, 145
 in rigidity, 22
 in spasticity, 21, 23, 74, 100
 in tension, 147, 148
 Influence of gravity in, 62, 60, 70, 71, 120, 155, 170
 normalcy, description of, 10, 23
 O. C., 118, 123

- Muscles—Cont'd
 re-education of, 170
 resisted motion in, 74, 75
 rest, avoidance of stretching, 128, 131
 tonus changes in, 155
 use of, in balance, 160

O

- O. C. muscle, definition of, 24, 118, 119
 description of, 24, 39, 118
 massage, use of, for, 123
 resisted motion, use of, in, 74, 119, 120
 rest, use of, for, 128
 testing for, 24, 39, 118
- One, Two, Button Your Shoe, leg training, by use of, 100
- Overflow, description of normal, 25, 26
 pathological, 26, 42
 avoidance of, in confused motion, 120
 treatment of, in active assisted motion, 63

P

- Parallel bars, (see Apparatus and equipment, 185)
 use of, in balance, 158
- Paraplegia, 32
- Parent, carryover from treatment to, 181
 explanation of treatment aim to, 34
 use of, in rest, 128
- Passive motion, use of, in treatment of ataxia, 60
 athetoid, in, 57, 58
 braces, aid in, 53
 conditioned motion, use of, in, 70, 78
 extension cuff, use of, in, 59
 purpose of, 51
 sandbags, use of, in 58
 spasticity in, 52, 53
 stretching in, 53-57
 summary of, 61
 tremor, in, 59, 60
- Petechial hemorrhage, 21
- Pool, not useful to treatment, 170
- Psychological examination, importance of, 18

Pulleys, weighed, (see Apparatus and equipment, 186)
use of, 64, 67, 71, 78
Pump the Water, arm training, by
use of, 84

Q

Quadriplegia, 32

R

Reach and grasp, purpose of, 176,
177

Reciprocation, description of, 78,
166, 170
motion from the relaxed position, use of, in, 152
purpose of, 168, 170
treatment for, 170, 175

Records in treatment, (see Muscle examination, 37, 43)
goniometer, 40
lateral tracing, 40
metronome timing used, 51,
52, 145, 181

Relaxation, aim in, 132, 133, 147,
150
description of, 132
explanation of, 133
in athetoid, 142, 145, 146
in spastic, 149
summary of, 151

Relaxation chair, (see Apparatus and equipment, 186)
use of, in balance, 159
in motion from the relaxed position, 153

Resisted motion, board, polished,
use of, in, 79
description of, 73
in spastically, 74
in tremor, 75
O. C. muscle, use of, in, 119,
120

summary of, 75
use of, in stasis, 75
in athetoid, 75
Rest, desired type of, 128, 131
need for, 128, 131
purpose of, 128
summary of, 131
Rhythms, beginning arm, 79, 80
leg, 79, 80

use of, 76, 77, 78
in relaxation, 145
words and music of, 82-117
Rigidity, description of, 22

Roll Over and Over, arm training,
by use of, 90
leg training, by use of, 108

S

Sandbags, description of, 58
use of, for athetoid, 58, 71
for tremor, 59
in conditioned motion, 78
in motion from the relaxed position, 153
in relaxation, 133, 146, 147,
148, 150
in skills, 178

Sherrington's law of reciprocal innervation, 23

Shoot the Rocket, arm training,
by use of, 82

leg training, by use of, 106

Sitting, purpose of, 156
treatment in, 156, 159, 160, 166,
176

use of, in skills, 178
Skills, description of, 178
treatment for, 178, 181

Skis, (see Apparatus and equipment, 186)

use of, in balance, 158, 159, 166,
157

in reciprocation, 170, 175

Spastic, active assisted motion, use
of, for, 62, 63

motion, use of, for, 70
balance, use of, for, 160

crutches, use of, in, 166
treatment in, 160

combined motion, use of, for,
125

conditioned motion, use of, for,
77, 80

early description of, 17

fear in, 28, 30, 36, 149, 150, 160

massage, use of, for, 48

muscle examination form, 37

explanation of use of, 38

examination of, 36, 37

type of, in, 23

O. C. muscle found in, 24, 118

overflow in, 25, 63

passive motion, use of, for, 52,
53

personality of, 27, 28, 38

reciprocation, use of, for, 175

relaxation, use of, for, 149, 150

resisted motion, use of, for, 74

rest, use of, for, 128, 131

rigidity, similar treatment to, 22

skills, use of, for, 178

stretching, use of, for, 53-57

Speech, 32
 Splints, purpose of, 123
 use of, in motion from the re-
 laxed position, 153
 in relaxation, 140
 in rest, 128
 Standard Lovett system of muscle
 grading, description of, 44
 Standing, parallel bars, use of, in, 158
 skills, use of, in, 158, 159
 treatment in, 158, 160, 107
 Stretch reflex, absence of, in O. C.
 muscle, 118
 avoidance of, in active as-
 sisted motion, 62-63
 balance, 160
 combined motion, 125
 confused motion, 120
 massage, 48
 passive motion, 52-53
 relaxation, 140
 resisted motion, 74
 characteristic in spastic, 21
 lack of, in rigidity, 22
 test of, 24, 30, 38
 Stretching, avoidance of, in O. C.
 muscles, 123
 in rest, 128, 131
 braces, need for, in, 57
 description of, 54-57
 need for, 53-54
 Sunbeams Rise and Fall, arm
 training, by use of, 86

T

Tension athetoid, description of, 147, 148
 differential test for, 147, 148
 relaxation, use of, for, 148
 This Way That Way, arm training,
 by use of, 92
 leg training, by use of, 112
 Thumbkins and Pointer, arm
 training, by use of, 90
 Trainer, requirements for, 182, 183
 Treatment, active assisted motion
 in, 62
 motion in, 72
 aims of, 27, 31-35, 132, 133, 147, 150
 Alexander ball, use of, in, 150
 approach in, 27, 38, 79, 142, 150, 155, 158, 160
 avoiding boredom in, 34, 64
 balance, use of, in, 155, 160

Treatment—Cont'd

board, polished, use of, in, 78, 79
 braces, wearing of, in, 53, 70, 71, 146, 147, 153, 159, 175
 combined motion, use of, in, 124, 125, 127, 176
 conditioned motion in, 77, 81, 175
 considerations necessary in, 35, 124
 constrained motion, use of, in, 120
 crawling, use of, in, 156, 160
 crutches, use of, in, 160
 exercises, use of, in, 82-117, 146
 extension cuff, use of, in, 59, 64, 70, 71, 146, 147
 gravity, use of, in, 62, 69, 70, 71, 120, 155, 170
 handedness in, 78, 177
 head balance, use of, in, 158, 159
 importance of personality in, 27
 kneeling, use of, in, 156, 158, 160, 166
 O. C. muscle, use of, in, 119, 120
 parallel bars, use of, in, 158
 passive motion, in, 53
 "pool", not useful to, 170
 pulleys, use of, in, 64, 67, 71
 reach and grasp, use of, in, 176
 dressing, use of, in, 177
 feeding, use of, in, 177
 typing, use of, in, 177
 reciprocation in, 78, 168, 170, 175
 relaxation, use of, in, 132, 133, 134, 135, 142, 148, 149
 outline, use of, in, 130-138
 resisted motion in, 73, 74, 75
 rest, use of, in, 128, 131
 rhymes, use of, in, 77, 78, 146
 sandbags, use of, in, 58, 59, 71, 146, 147, 150, 153
 sitting, use of, in, 156, 159, 160, 160
 skills, use of, in, 178, 181
 skis, use of, in, 158, 159, 166, 167, 170, 175
 standing, use of, in, 158, 160, 167
 stretching, in, 53-57
 timing, sense of, in, 51, 67, 70, 81
 "walker", not useful to, 170
 Tremor, active assisted motion,
 use of, in, 66
 motion, use of, in, 71
 description of, 21

Tremor—*Cont'd*

- intention and non-intention, 22
- personality of, 29
- massage, avoidance of, in treatment of, 50
- passive motion, use of, in, 59, 60
- resisted motion, use of, in, 75
- skills, use of, in, 178

Triplegia, 32

- Typing, use of, in reach and grasp, 177
- skills, 180

U

- Up and Down, arm training, by use of, 88
- leg training, by use of, 110

V

- Vieland Training School, New Jersey, Research Department, 19

W

- Walker not useful to treatment, 170
- Walking, braces, use of, in, 175
- importance of, 33
- skis, use of, in, 170
- treatment in, 116

Y

- Yankee Doodle, leg training, by use of, 102